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FAO Fisheries Synopsis No. 1 Revision 1
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PREPARATION OF SYNOPSES ON THE BIOLOGY OF SPECIES OF LIVING AQUATIC ORGANISMS

Prepared by
H. ROSA Jr.

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1965

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FAO Fisheries Report **FIb/R (No.)**

FAO Fisheries Circular **FIb/C (No.)**

FAO Fisheries Synopsis **FIb/S (No.)**

Special groups of synopses are identified by symbols followed by classification numbers based on indexed code of " Current Bibliography ":

SAST	Data concerning certain species and fish stocks.
MAST	Information on methods and subjects.
OT	Oceanographic data.
IT	Limnological data.
CART	Information concerning fisheries and resources of certain countries and regions (FID/S).

Des catégories spéciales d'études synoptiques sont identifiées à l'aide de symboles suivis des chiffres de classification basés sur le code d'indexation de la « Current Bibliography »:

SAST	Données sur certaines espèces et populations de poissons.
MAST	Renseignements sur des méthodes et des sujets.
OT	Données océanographiques.
IT	Données limnologiques.
CART	Renseignements sur les pêcheries et les ressources de certains pays et régions (FID/S).

Grupos especiales de sinopsis se distinguen con las siglas siguientes, seguidas por números de clasificación que se basan en las claves de los índices de la « Current Bibliography »:

SAST	Datos relativos a ciertas especies y poblaciones.
MAST	Sinopsis sobre métodos y materias.
OT	Sinopsis sobre oceanografía.
IT	Sinopsis sobre limnología.
CART	Información sobre los recursos acuáticos vivos de algunos países y regiones (FID/S).

FAO Fisheries Technical Paper FIb/T (No.)

Special groups of Technical Papers are identified by:

RE	Indexed lists of experts and institutions drawn from Registers maintained by Biology Branch.
CB	Lists of Periodicals, special sections of " Current Bibliography for Aquatic Sciences and Fisheries," special bibliographies and papers concerning documentation problems.
MFS	Provisional editions of " FAO Manuals in Fisheries Science."

Some documents also have another identification, if, for example, they have been contributed to a meeting for which papers have been numbered according to another system.

Des catégories spéciales de documents techniques sont identifiées à l'aide des symboles suivants:

RE	Listes indexées d'experts et institutions tirées des registres tenus à jour par la Sous-division de la biologie.
CB	Listes de périodiques, des sections spéciales de la « Current Bibliography for Aquatic Sciences and Fisheries », des bibliographies particulières et des articles sur les problèmes de documentation.
MFS	Editions provisoires des « Manuels FAO de la science des pêches ».

Il arrive que certains documents portent d'autres numéros d'identification, comme c'est le cas s'ils ont été préparés pour une réunion dont les documents ont été marqués à l'aide d'un autre système.

Grupos especiales de documentos técnicos se identifican por las siglas siguientes:

RE	Listas índices de expertos y de instituciones tomadas de los registros que se llevan en la Subdirección de Biología.
CB	Listas de periódicos, secciones especiales de la « Current Bibliography for Aquatic Sciences and Fisheries », bibliografías especiales y trabajos relativos a los problemas de documentación.
MFS	Ediciones provisionales de los « Manuales FAO de la Ciencia de la Pesca ».

Algunos documentos tienen también otra identificación si, por ejemplo, son contribuciones a una reunión cuyos documentos han sido marcados con arreglo a otros sistemas.

PREPARATION OF SYNOPSES ON THE

BIOLOGY OF SPECIES OF LIVING AQUATIC ORGANISMS

Prepared by

H. Rosa, Jr.,
Biology Branch, Fisheries Division, FAO

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, June 1965

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c.1

PREPARATION OF THIS DOCUMENT

This paper is a revised and expanded version of the original document (FB/S1). It includes under chapter II the Outlines for Synopses of Data on Species and Stocks (Plants) and (Whales), contains a progress report on the preparation of synopses on the biology of various living aquatic organisms, and gives information on the FAO Working Party on Species Synopses being organized basically to coordinate and encourage the preparation of synopses.

Distribution

FAO Fisheries Division
FAO Regional Fisheries Officers
UNESCO
Regional Fisheries Councils and Commissions
Selectors 2 and 5

"Current Bibliography" entry

Rosa, H. Jr. (1965)
FAO Fish.Synops., (1) Rev.1: 75 p.
Preparation of synopses on the biology of species of living aquatic organisms

Revised and expanded version of the original document. Contains outlines for and a progress report on the preparation of synopses on the biology of various living aquatic organisms; gives information on the FAO Working Party on Species Synopses.
Co 62-00986

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C O N T E N T S

		Page
I	SCOPE, PURPOSE AND PATTERN	1
II	THE OUTLINE OF THE SYNOPSES	1
III	SYNOPSES PREPARED OR IN PREPARATION TO DATE	38
IV	COLLABORATION WITH OTHER ORGANIZATIONS	49
V	FAO WORKING PARTY ON SPECIES SYNOPSES	51
VI	REFERENCES	52
	APPENDIX I - GEOGRAPHIC CLASSIFICATION AND CODES	53
	APPENDIX II - NATURAL REGIONS OF THE OCEANS	68

I SCOPE, PURPOSE AND PATTERN

The Fisheries Biology Branch of FAO as stated in FAO, Fisheries Division, Biology Branch (1960), "is concerned with scientific studies of the exploited and potential living resources of the oceans, and with the application of the information obtained for the better and fuller use of those resources. To this end the Branch compiles, interprets and disseminates pertinent facts; it is concerned with improving the methods of fisheries biological and fisheries oceanographic research, promoting the wider use of these methods, and encouraging the application of the results of research for the improvement of fisheries and the increase of fish yields".

For example, the Branch has compiled facts about the taxonomy, distribution, bionomics and life history, population, and exploitation of species of fish and other aquatic organisms, particularly those of economic value. Synopses of this information are being assembled following the outlines set out in Section II. The primary purpose of these synopses is to make existing information readily available according to a standard outline for easy consultation and to indicate gaps in knowledge of the biology of the species considered. They have been designed for the use of scientists working on the various areas of distribution of the species, scientists initiating investigations of the species or related ones, and scientists interested in a basis for comparative study of resources. In addition they should be useful to fishery oceanographers, economists, technologists and administrators as a source of facts relevant to the species.

The Branch plans to revise the synopses from time to time as new information becomes available. For this purpose a standard format has been designed to allow their filing in loose-leaf folders, pagination beginning anew with each chapter, so that partial revisions may be made.

Comments and requests for information should be addressed to the editor and co-ordinator of the series:

Horacio Rosa, Jr.
Fisheries Division, Biology Branch
FAO of the United Nations
Viale delle Terme di Caracalla
Rome, Italy

II THE OUTLINE OF THE SYNOPSES

The first outline for preparation of synopses as set out on pages 4 - 6, (Outline, Version No. 1), was initially presented at the Symposium on the Comparative Biology of Marine Species Studied in Different Districts of their Area of Distribution at Roscoff, France, 24 June - 4 July 1956. It was published in the proceedings of the symposium (Kesteven, Rosa and Holt, 1958). The outline was again presented at the Ninth Annual Session of the Gulf and Caribbean Fisheries Institute, Nassau, Bahamas,

November 1956, and also published in the proceedings of the Nassau meeting (Rosa, 1957).

To test the outline trial synopses were prepared in FAO. These are listed as references 18, 19, 60, 61 and 62 of Section III. Each trial synopsis dealt with one or several species. Thus one synopsis encompassed information on all whale species. These synopses were distributed among scientists studying the species considered and although they were first and incomplete drafts, they were well received and the system was commended.

Scientists were then requested to prepare synopses on cod, milkfish and species of groupers, using the outline. Subsequently it was also used in a larger operation by sardine biologists to prepare fourteen synopses on the biology of species of Sardina, Sardinella and Sardinops as listed in Section III. They were prepared for the World Scientific Meeting on the Biology of Sardines and Related Species held by FAO in Rome in September 1959. Although these authors found the outline generally suitable, their opinion was that it should be annotated more clearly to indicate the data to be reduced, and to avoid duplication of information listed under the different items.

An annotated outline has been prepared by FAO. It is given as Outline, Version No. 2 on pages 7 - 30. Alterations in some instances have been made but changes were kept to a minimum.

The annotations (unnumbered subheadings) are not yet intended to be exhaustive or systematic, but a preliminary attempt to define kinds of data and results to be included under each subtitle. Authors of future synopses are invited to suggest additions or changes to be considered in a future revision of that outline.

Comments on this outline have been made by: G.L. Kesteven, CSIRO, Australia; J.P. Wise, U.S.A.; W. H. Schuster, Netherlands; I.G. Baxter, United Kingdom; J.B. Kimsey, U.S.A.; and W.D.L. Ride, Australia; FAO deeply appreciates their collaboration. Special gratitude is expressed to Dr. Kesteven, who, as Chief of the Biology Branch, Fisheries Division, FAO, originated together with the author the synopsis operation, and who has since continually helped its development with valuable advice and cooperation; to Dr. Ride, Director of the Western Australian Museum, for his revision of the section on identity; and to Mr. W.A. Dill, FAO, Rome, who drafted sections 6 and 7.

During the preparation of Outline, Version No. 2, the Outline for an Ecological Life History Study of a Fish (Koster, 1955) was consulted and used to a certain extent.

Outline, Version No. 2, will be used as standard until further notice. It replaces Outline, Version No. 1, but Outline Version No. 1 would still be used for synopses originally drafted according to this outline and now being revised, unless the authors wish to use Outline, Version No. 2.

Outline, Version No. 1 has been adapted to the biology of plants (see pages 31-34) by Professor Jean Feldmann of the Laboratoire de Biologie Végétale Marine, Faculté des Sciences, Université de Paris, to be used in the preparation of synopses on the biology of seaweeds. An adaptation of items 3 and 4 of Outline, Version No. 2 has been made by Dr. R.G. Chittleborough, Western Australian Regional Laboratory, Division of Fisheries and Oceanography, CSIRO, to the biology of whales. (see pages 35-37).

OUTLINE, VERSION NO. 1

OUTLINE FOR SYNOPSIS OF DATA ON SPECIES AND STOCKS

1 IDENTITY

1. 1 Taxonomy

1. 1. 1 Definition
1. 1. 2 Description

1. 2 Nomenclature

1. 2. 1 Valid scientific names
1. 2. 2 Synonyms
1. 2. 3 Standard common names, vernacular names

1. 3 General variability

1. 3. 1 Subspecific fragmentation (races, varieties, hybrids)
1. 3. 2 Genetic data (chromosome number, protein specificity)

2 DISTRIBUTION

2. 1 Delimitation of the total area of distribution and ecological characterization of this area

2. 2 Differential distribution

2. 2. 1 Areas occupied by eggs, larvae and other junior stages: annual variations in these patterns, and seasonal variations for stages persisting over two or more seasons.

2. 2. 2 Areas occupied by adult stages: seasonal and annual variations of these.

2. 3 Behaviouristic and ecological determinants of the general limits of distribution and of the variations of these limits and of differential distribution

3 BIONOMICS AND LIFE HISTORY

3. 1 Reproduction

3. 1. 1 Sexuality (hermaphroditism, heterosexuality, intersexuality)
3. 1. 2 Maturity (age and size)
3. 1. 3 Mating (monogamous, polygamous, promiscuous)
3. 1. 4 Fertilization (internal, external)

3. 1. 5 Fecundity
- Relation of gonad size and egg number to body size and to age
- Coefficient of fecundity

3. 1. 6 Spawning
- Spawning seasons (beginning, end, peak)
- Number of spawnings per year, frequency
- Spawning time of day
- Induction of spawning, artificial fertilization

3. 1. 7 Spawning grounds
- Coastal (surface, vegetation, shore, shoal, sand, shelter); bottom
- Oceanic (surface, bottom)

3. 1. 8 Egg: structure, size, hatching type, parasites, and predators

3. 2 Larval history

3. 2. 1 Account of embryonic and juvenile life (prelarva, larva, postlarva, juvenile)
- Feeding
- Rates of: development and survival
- Periods of: development and survival
- Parental care
- Parasites and predators

3. 3 Adult history

3. 3. 1 Longevity
3. 3. 2 Hardiness
3. 3. 3 Competitors
3. 3. 4 Predators
3. 3. 5 Parasites and diseases
3. 3. 6 Greatest size

3. 4 Nutrition and growth

3. 4. 1 Feeding (time, place, manner, season)
3. 4. 2 Food (type, volume)
3. 4. 3 Relative and absolute growth patterns and rates
3. 4. 4 Relation of growth to feeding, to other activities, and to environmental factors

3. 5 Behaviour

3. 5. 1 Migration and local movements
3. 5. 2 Schooling
3. 5. 3 Reproductive habits

4 POPULATION (STOCK)

4. 1 Structure

4. 1. 1 Sex ratio

4. 1. 2 Age composition
4. 1. 3 Size composition

4. 2 Size and density

4. 2. 1 Average size
4. 2. 2 Changes in size
4. 2. 3 Average density
4. 2. 4 Changes in density

4. 3 Natality and recruitment

4. 3. 1 Natality
4. 3. 2 Natality rates

4. 4 Mortality, morbidity

4. 4. 1 Rates of mortality
4. 4. 2 Factors or conditions affecting mortality
4. 4. 3 Factors or conditions affecting morbidity
4. 4. 4 Relation of morbidity to mortality rates

4. 5 Dynamics of population

4. 6 Relation of population to community and ecosystem, biological production, etc.

5 EXPLOITATION*

5. 1 Fishing equipment

5. 1. 1 Fishing gear
5. 1. 2 Fishing boats

5. 2 Fishing areas

5. 2. 1 General geographic distribution
5. 2. 2 Geographical ranges (latitudes, distances from coast, etc.)
5. 2. 3 Depth ranges

5. 3 Fishing seasons

5. 3. 1 General pattern of fishing season
5. 3. 2 Duration of fishing season
5. 3. 3 Dates of beginning, peak and end of season
5. 3. 4 Variation in time or duration of fishing season
5. 3. 5 Factors affecting fishing season

5. 4 Fishing operations and results

5. 4. 1 Effort and intensity
5. 4. 2 Selectivity
5. 4. 3 Catches

5. 5 Fisheries management and regulations

5. 6 Fish farming, transplanting and other intervention

*Only information of relevance for the understanding of the biology of the species and effect of exploitation on the stocks should be considered.

OUTLINE, VERSION NO. 2

DRAFT OF ANNOTATED OUTLINE FOR SYNOPSIS OF DATA ON SPECIES AND STOCKS

GENERAL NOTES

(Instructions)

a) Tables, graphs, text-figures and photographs

Facts to be presented as far as possible by tables, graphs, diagrams and charts. Maps of distribution and fishing grounds to be always included, as well as accurate illustration of the species. Other illustrations of development of young phases, fishing gear, etc., are also of interest, but the total number should not exceed six illustrations.

Unless sufficiently small to be inserted in the text, tables should be set out on separate sheets of the same size as those used for the text, numbered consecutively with Roman numerals and referred to throughout the text as "Table I", etc. Each table must have a title and, where necessary, a descriptive legend. The title of the contribution and the name of the author should be written on the back of each table in pencil.

Make separate pages for text-figures and photographs. Each should carry a legend clearly typed or written. Text figures and photographs should be numbered consecutively with arabic numerals, and referred to throughout the text as "Fig. 1", etc. There should be ample references in the text to figures and these should be carefully checked for consistency. They must not be so large that they need to be reduced to less than one-third of their original size. All drawings, charts, maps and diagrams should be prepared in waterproof Indian ink on high quality paper or on tracing cloth. Graph paper must have blue or faint grey rulings. No erasures should be made. Thickness of lines should be judged remembering the size to which they will be reduced for publication; they should be heavy enough, yet not so heavy that they overweight the printed page. Lettering should be done in capitals and in Roman form only. The coordinates of graphs must be carefully defined, labelled, and their units identified. Photographs should be sharp and on glossy or smooth paper.

b) Selection of data

Authors to select data to be included and distinguish as clearly as possible between factual statements, interpretations, hypotheses, theories and opinions.

c) Quantitative information

Under each heading calling for quantitative information give absolute values where appropriate, or mean values with some measure of reliability, (variance, range, sample, size, etc.). Record where possible the determinants of the values displayed; show relations by regression or other equations (defining clearly the attributes measured, the method of measure, the units, accuracy and precision of measurement). Indicate closeness of relations by correlation coefficients or other statistically valid methods.

All quantities should be given in numerals (not words) and in the units of the metric (c.g.s.) system.

Use abbreviations rather than symbols for units of measurement and time (e.g. 10 sec rather than 10").

d) Measurements and counts of fish and shellfish

Manual of Methods in Fisheries Biology (FAO, Fisheries Division, Biology Branch, in press) to be used for specifications of fish and shellfish measurements and counts (Section 4.4 Measurements and counts of fish and shellfish).

e) Style

Style Manual for Biological Journals (Conferences of Biological Editors, 1960), to be used for general style of presentation. For bibliographies see i).

f) Geographic distribution and fishing areas

"Geographic Classifications, Land Areas and Water Areas" of the Current Bibliography for Aquatic Sciences and Fisheries (see Appendix I) to be used for description of geographic distribution and fishing areas (2.1 and 5.21) of the species. Land areas to be listed with their respective three digit code. Water areas to be listed with their respective letter code. The corresponding names of the land and water areas to be also listed at least once in the synopsis, i.e., 111 Tunisia; AN Atlantic, N.

g) Biogeographical and natural characteristics of areas of distribution

In considering the biogeographical and natural characteristics of the area of distribution of the species, and related subjects, reference should be made to the natural regions of the oceans as listed in Table I and illustrated in Figure 2 of the Appendix II. The oceans are divided in the table and figure into natural regions on the basis of meteorological, oceanographic and biological factors so that a region can be easily characterized by the average and extreme values of these factors. In the absence of data on the optimum environmental

factors and the extreme conditions determining the distribution, abundance and behaviour of the species, certain use can be made of these regional characteristic values. There are regions with similar characteristics, though geographically far apart (Table II, Appendix II). Use can again be made of this fact for drawing upon information from better investigated similar regions for application in a less investigated corresponding region.

h) Size of synopses, scientific names, footnotes

The size of a synopsis covering the biology of only one species should not exceed 50 pages.

Footnotes to be numbered consecutively and each one typed in the text at the place to which it refers, within horizontal lines.

Scientific names should be carefully checked for correct spelling and those below the level of family underlined. The full common and scientific names must be given for each species when it is first referred to.

i) Bibliographic references

These should follow the basic rules adopted for the "Current Bibliography for Aquatic Sciences and Fisheries" and specifically as follows:

- Monographs:

Author's name, followed by his initials (comma); title of the book (stop); city of publication (comma); publisher's name (stop); number of pages. The year of publication is given in the second line, leaving four spaces blank before and after the year number, e.g.

Lerner, I.M., The genetic basis of selection. New York, J. Wiley.
1958 298 p.

- Periodicals or series:

The rules are the same as above except that the place of publication and publisher's name are omitted. After title of paper in its original language quote name of periodical or serial, abbreviated according to the rules of the "World List of Scientific Periodicals", London, Butterworths Publ., 1952, and underline (comma); vol. number in arabic numbers, number of issue in parentheses (colon); pages from - to.

If there are two or three authors: enter first author's name, followed by his initials and then initials of the second author followed by his name and initials of third author followed by his name.

If there are more than three authors: enter first author's name, followed by his initials and followed by et al.

Only the first word of the title of a publication and proper names are given capital initials.

If correct abbreviation of periodical is unknown, quote full title of periodical.

Examples:

Kühl, H., 1958 Die Verteilung des Fettes im Körper des roten Thunes (Thunnus thynnus L.). Arch.Fisch-Wiss., 9(1):1-8

Anonymous, 1958 California - Albacore tuna occurrence and migration pattern studies (M/V Alaska cruise 58A3 - Albacore). Comm.Fish.Rev., 20(9):30-1

Kurogane, K. and Y. Hiyama, 1957 Morphometric characteristics of the albacore Germo germo from the northwest Pacific. Rec.oceanogr.Wks Jap., 4(1):67-75

Literature citations in the text should be made by quoting author's surname followed in parentheses by date of publication.

1 IDENTITY

1. 1 Nomenclature

1. 11 Valid name

- Original combination under which the name of the species was originally published together with the author's name, exact date of publication if known and a full reference to the original publication.

1. 12 Objective Synonymy

- If the original combination in 1. 11 above is a replacement for an earlier invalid name, this should be stated here.

- If the valid name possesses junior objective synonyms, then these should be listed here in chronological order.

1. 2 Taxonomy

1. 21 Affinities

Suprageneric

- Phylum, class, order or family. If the species is a fish, the categories Order and Family should be those of Berg (1947).

Generic

- Generic name with which species is associated by current author, author of generic name, full reference to original description of genus, name of genotype.

and either

(a) Statement of generic concept as used by current author, i.e., diagnostic description of genus and list of the species which it includes.

(b) Subjective generic synonyms. List of these genera subjectively included by current author in his concept of genus. In each case the genotype of the synonymised generic name should be included in parentheses immediately following that name.

- or

(a) Statement that present author is following the generic concept of another author, check list, etc. (giving full reference), together with statement of diagnostic characters of that genus as used by the quoted author.

Specific

- Identity of type specimens.
  If designated subsequent to the original description, cite reference to designation.

- Type locality.
  If designated subsequent to original description cite reference to designation.

- Diagnosis.
  Brief diagnosis listing the most important characters peculiar to the species and by which it can be differentiated from closely related ones.

- If material has been examined by Present Author.
  This should include a statement which will indicate the grounds upon which the present author's animals are allocated to the species as represented by its type specimen. For the benefit of future workers it should also include a statement that one or more specimens used by the present author for determination of identity has been deposited in a public collection (e.g. a museum).

- Subjective synonymy.
  List the names of those species which have been placed in the subjective synonymy of the species name adopted here. Each name should be followed by the original reference to its description; this should in turn be followed by the reference given to the original work in which the synonymy was established. (This latter reference to be preceded by the words "placed in synonymy in", and followed by either the words "reasons discussed" or "reasons not given"). If the synonymy is the result of work of the present author, he must refer to a separate publication which sets out his arguments and conclusions.

- Artificial key to the identification of all the species of the genus included in the

generic concept as defined above (dichotomous, bracket key, indented key, or most suitable).

1. 22 Taxonomic status

- Is status understood? i.e., is it a morpho species or species established by breeding data?

- Is species polytypic or does the present author suspect that it may be a geographical morphological form of a polytypic species.

1. 23 Subspecies

- List of subspecies recognized by current author together with type localities and references to original descriptions.

1. 24 Standard common names, vernacular names

- Standard common names; official or the most commonly used names in the various countries within the area of distribution of the species.

- Vernacular names; any name ascribed to the species in the various countries within the area of its distribution.

1. 3 Morphology

1. 31 External morphology (For description of spawn, larvae, and adolescents, see 3. 17; 3. 22; 3. 23).

- Generalized. To include quantitative data indicating individual variation.

- Geographic variation.

- Morphological definition of subpopulations that can be distinguished on such variation.

- Description of morphological changes which occur during growth including quantitative data.

1. 32 Cytomorphology

- Chromosome number, etc.

1. 33 Protein specificity

- Results of comparative serology.

2 DISTRIBUTION

2. 1 Total area /Refer to general notes (f) and (g)/

- Geographic distribution (political or geographical designations, or degrees of latitude and longitude); geological features; drainage basins, climatic conditions and altitudes (freshwater); changes caused by man.

- Biogeographical and natural characteristics; encompassing physical, dynamical and chemical characteristics; flora and fauna composition.

2. 2 Differential distribution

2. 21 Spawn, larvae and juveniles

- areas of occurrence and seasonal variations.

2. 22 Adults

- areas of occurrence and seasonal and annual variations.

2. 3 Determinants of distribution changes

- Effects of ecological determinants such as temperature, currents, waves, depth, colour of water, light, turbidity, substratum, shelter, ice, dissolved gases, dissolved (inorganic) solids, organic compounds, pollution, vegetation and fauna, on general and differential distribution on different stages of development of individuals of the species.

- Behaviouristic determinants, spawning, feeding, etc., of general and differential limits of distribution.

- Adaptability or tolerance as determinants of differential distribution.

2. 4 Hybridization

2. 41 Hybrids; frequency of hybridization; species with which hybridization occurs; methods of hybridization.

2. 42 Influence of natural hybridization in ecology and morphology.

3 BIONOMICS AND LIFE HISTORY

3. 1 Reproduction

3. 11 Sexuality

- Hermaphroditism, heterosexuality, intersexuality
- Nature and extent of hermaphroditism
- Sexual dimorphism

3. 12 Maturity

- Age at which sexual maturity is reached and its variations with sex, subpopulations, size, and rate of growth
- Size and weight at sexual maturity

3. 13 Mating

- Monogamous, polygamous, promiscuous

3. 14 Fertilization

- Internal
- External

3. 15 Gonads

- Relation of gonad size and egg number to body length and weight, to age
- Coefficient of fecundity
- Number of eggs or broods produced by an individual during a year, and during a lifetime
- Variation in fecundity with health or condition
- Correlation between the number of spawn or young produced and the nature of the environment

3. 16 Spawning

- Number of spawnings per year

- Spawning seasons (beginning, peak, end)
- Spawning time of the day
- Sequence of spawning of individuals in a population
- Factors influencing spawning time; temperature, runoff, photoperiod, lunar or tidal cycles, size, age, latitude, altitude
- Relation of the time of breeding to that of related and/or associated species
- Location and type of spawning ground
- Variations and causes of variation of spawning grounds
- Ratio and distribution of sexes on spawning grounds
- Nature of mating act
- Variation in mating behaviour
- Nesting habits
- Reproductive isolation
- Induction of spawning

3. 17 Spawn

(Defined as laid eggs, either unfertilized or fertilized)

Description of external morphology

- Size, shape, colour, opacity, texture, type of membrane, degree of buoyancy and adhesiveness
- Size and shape of vitellus, vitelline membrane, number of oil globules

3. 2 Pre-adult phase

(Defined as from fertilization of egg to sexual maturity)

3. 21 Embryonic phase
(Defined as from fertilization to hatching; i.e. during incubation period)

- General features of development of embryo
- Rates and periods of development and survival and factors affecting these, including parental care
- Parasites and predators
- Effect of environment, spawn size and sub-populations on rates of development and survival
- Mode of hatching or birth

3. 22 Larvae phase

/Defined as from hatching until metamorphosis (transformation) to the essentially adult form; divided into pro-larval phase (with yolk-sac) and post-larval phase (after final disappearance of yolk, but form and structure still strikingly different from adult)/.

- General features of development
- Rates and periods of development and of survival and factors affecting these, including parental care, parasites and predators
- Effect of environment, subpopulations, density on rates of development and survival
- Time of first feeding
- Type of feeding

3. 23 Adolescent phase

(Defined as post-metamorphosis when young and immature fish are essentially similar to adult in form, habitat, food, etc., but not yet sexually mature).

- General features of development
- Rates and periods of development and survival and factors affecting these including diseases, parasites and predators
- Effects of environment, subpopulations, density on rates of development and survival
- Differences from adults in diet, feeding, methods, etc.

3. 3 Adult phase

(Mature fish)

3. 31 Longevity

- Average life expectancy
- Maximum age
- Variations in the average and maximum longevity within populations, sex, rate of growth, etc.

3. 32 Hardiness

- Limits of tolerance to changes in or of environment and feeding
- Limits of tolerance to handling and life in aquaria or other confined environments
- Variations in hardiness with age, size and physiological states

3. 33 Competitors

- Types and abundance of competitors for spawning area, food, shelter, etc.

3. 34 Predators

- Types of predators
- Defense reactions
- Variations in defense reactions with age, size and physiological states
- Predation as controlling factor of size, density, and size composition of population

3. 35 Parasites, diseases, injuries and abnormalities

- Parasites and diseases
- Types
- Modes of infection
- Stages of parasites
- Intensity of individual and population infection

- Determinant factors of degree of infection
- Effects on physiology, behaviour and food value of individuals
- Effect on population density
- Ability of recovery
- Injuries and abnormalities
- Nature and causes
- Ability of regeneration
- Effect on physiology and survival of individuals

3. 4 Nutrition and growth

3. 41 Feeding

- Time of day
- Place; general area
- Manner; methods of capture, selection
- Frequency
- Variation of feeding habits with availability, season, age, size, sex, physiological condition
- Abstention from feeding

3. 42 Food

- Types eaten and their relative importance in the diet
- Volume of food eaten during a given feeding period

3. 43 Growth rate

- Relative and absolute growth patterns and rates
- Condition factors (Ponderal index)
- Relation of growth to feeding, spawning, to other activities and environmental factors (temperature, crowding, etc.)
- Relation of growth to population density
- Food-growth relations

3. 44 Metabolism

- Metabolic rates
- Standard
- Active
- Endocrine systems and hormones
- Osmotic relations

3. 5 Behaviour

(For feeding behaviour, see 3. 41, for reproduction behaviour, see 3. 13, 3. 21)

3. 51 Migrations and local movements

- Extent of movements or migrations
- Function of migration
- Direction of movements
- Mode of migratory movements
- Time or season of migration
- Changes in pattern of movements or migrations with age, physiological state, season, temperature and environmental conditions

3. 52 Schooling

- Extent of schooling habits
- Composition of stocks by size, age and sex
- Mixing of stocks within species at various stages of the life cycle
- Mixing between species
- Patterns of schools
- Vertical movements
- Size density and behaviour of schools in relation to time of day, geographic location, season, oceanographical factors, physiological conditions

- Aggregation (local concentration of several separate schools of some species or various species)

3. 53 Responses to stimuli

- Environmental stimuli
- Mechanical (reactions to pressures, currents, sound)
- Chemical (olfactory, gustatory, salinity gradients)
- Thermal (temperature)
- Optical (light)
- Artificial stimuli
- Fishing gear components, model gear
- Electrical
- Variations in reactions occurring with age, size, sex stage of development and physiological state

4 POPULATION

4. 1 Structure

4. 11 Sex ratio

- Sex ratio of population
- Sex ratio of the catch
- Variations of ratios with size, age and season
- Sex ratio on spawning grounds

4. 12 Age composition

- Age composition of the population as a whole
- Age distribution of the catch
- Variations with depth, distance off the coast, density, time of day, season
- Age at first capture
- Age at maturity
- Maximum age
- Density of age groups

4. 13 Size composition

- Length composition of the populations as a whole
- Length composition of the catch for each age group over the whole range of distribution of the species
- Variations with depth, distance off the coast, density, time of day, season
- Size at first capture
- Size at maturity
- Maximum size
- Density of size groups
- Length and weight relationship

4. 2 Abundance and density (of population)

4. 21 Average abundance

- Estimation of population size

4. 22 Changes in abundance

- Changes caused by hydrographic conditions, food competition, predation, fluctuations and fishing

4. 23 Average density

- Annual mean density
- Density of adult females

4. 24 Changes in density

- Landings per unit of fishing effort
- Variations with depth
- Seasonal variations in available stock

4. 3 Natality and recruitment

4. 31 Reproduction rates

- Annual egg production rates
- Survival rates (eggs, larvae)
- Forecasting of potential yields

4. 32 Factors affecting reproduction

- Density dependent factors: cannibalism, food supply, predation
- Physical factors: water movements affecting distribution, temperature, storms, direction and strength of winds and brood strength

4. 33 Recruitment

- Mean recruitment to the fishable stock
- Factors determining recruitment (growth, transformation, movements).
- Seasonal pattern of recruitment

- Variation in annual recruitment
- Relation of recruitment to stock size and reproductive rate.

4. 4 Mortality and Morbidity

4. 41 Mortality rates

- Annual mean mortality rates
- Instantaneous or logarithmic mortality coefficient
- Fishing mortality coefficient
- Natural mortality coefficient
- Variations in mortality
- Density dependence of natural mortality

4. 42 Factors causing or affecting mortality

- Predators
- Food of larvae and post-larvae and its availability
- Physical factors
- Direct effects of fishing
- Indirect effects of fishing

4. 43 Factors affecting morbidity

- Parasites and diseases
- Physical factors

4. 44 Relation of morbidity to mortality rates

4. 5 Dynamics of population (as a whole)

- Construction and application of mathematical models for long and short term predictions of characteristics of catches of a unit fishery considering required population parameters

4. 6 The population in the community and the ecosystem

- Physical features of the biotope of the community
- Species composition of the community and relative sizes of their populations
- Interrelations of the population of the species in the community and ecosystem; place in the food chain; trophic level, etc.
- Type of fluctuations (cyclic and non-cyclic)
- Changes in environmental factors and their effect on the population

5 EXPLOITATION

5. 1 Fishing equipment

5. 11 Gears

- Present gear (type, type and size of twine, webbing, shape, assembly, size, mesh size)
- Changes in types of gear during the development of the fishery
- Use of echosounding or fish detectors
- Use of light attraction (type of light, power)
- Other methods of attraction: sound, chumming, etc.

5. 12 Boats

- Type
- Size
- Power
- Changes in types of boats during the development of the fishery

5. 2 Fishing areas (Refer to General Notes "f")

5. 21 General geographic distribution

- Geographic distribution (political or geographical designations or degrees of latitude and longitude)

5. 22 Geographic ranges

- Distances from coast
- Drainage basins
- Areas of greatest abundance (political or geographical designations or degrees of latitude and longitude)
- Differential abundance associated with hydrographical features (Refer to General Notes "g")
- Changes in ranges during development of the fishery

5. 23 Depth ranges

- Bathymetric contour
- Variations of density with depth

5. 24 Conditions of the grounds

5. 3 Fishing seasons

5. 31 General pattern of season(s)

- Pattern of season(s) within whole fishing area

5. 32 Dates of beginning, peak and end of season(s)

- Approximate dates in various fishing areas

5. 33 Variation in date or duration of season

- Variations caused by climate, availability, regulations, economic factors, etc.

5. 4 Fishing operations and results

5. 41 Effort and intensity

- Type of unit of effort
- Landings per unit of fishing effort
- Catches per unit of fishing effort
- Fishing effort per unit area
- Total fishing intensity
- Causes of variation in fishing effort and intensity

5. 42 Selectivity

- Selective properties of gear
- Changes in mesh size and their effects
- Other selection factors: hook size, market preference, etc.

5. 43 Catches

- Total annual yields
- Total annual yields from different fishing grounds
- Maximum equilibrium yield

6 PROTECTION AND MANAGEMENT (Including that of the Aquatic Environment)[1/]

6. 1 Regulatory (legislative) measures

6. 11 Limitation or reduction of total catch

- Limitation on the efficiency of fishing units
- Limitation on the number of fishing units, fishermen
- Limitation on total catches (quota): daily, seasonal, annual

6. 12 Protection of portions of population

- Closed areas such as spawning or nursery grounds
- Closed seasons
- Limitations on size or efficiency of gear or craft
- Restrictions based on sex or condition
- Restrictions on use of fish

6. 2 Control or alteration of physical features of the environment

6. 21 Regulation of flow

6. 22 Control of water levels

6. 23 Control of erosion and silting

6. 24 Fishways at artificial and natural obstructions

6. 25 Fish screens

6. 26 Improvement of spawning grounds

6. 27 Habitat improvement

6. 3 Control or alteration of chemical features of the environment

6. 31 Water pollution control

6. 32 Salinity control

6. 33 Artificial fertilization of waters

1/ Many of the sub-sections of Sections 6. 2, 6. 3, 6. 4 and 6. 5 have primary pertinence to inland fishes.

6. 4 Control or alteration of the biological features of the environment

- 6. 41 Control of aquatic vegetation
- 6. 42 Introduction of fish foods (plant, invertebrate, forage fishes)
- 6. 43 Control of parasites and disease
- 6. 44 Control of predation and competition
- 6. 45 Population manipulation

6. 5 Artificial stocking

- 6. 51 Maintenance stocking
- 6. 52 Transplantation; introduction

7 POND FISH CULTURE 2/

7. 1 Procurement of stocks

7. 2 Genetic selection of stocks

7. 3 Spawning (artificial; induced; natural)

7. 4 Holding of stock

7. 5 Pond management (fertilization; aquatic plant control; etc.)

7. 6 Foods; feeding

7. 7 Disease and parasite control

7. 8 Harvest

7. 9 Transport

2/ Of primary pertinence to inland fishes.

OUTLINE FOR SYNOPSIS OF DATA ON SPECIES AND STOCKS (PLANTS)[1/]

1 IDENTITY

1.1 Taxonomy

1.1.1 Definition
1.1.2 Description

1.2 Nomenclature

1.2.1 Correct scientific names
1.2.2 Synonyms
1.2.3 Standard common names, vernacular names

1.3 General variability

1.3.1 Subspecific fragmentation (races, varieties, hybrids)
1.3.2 Genetic data (chromosome number, protein specificity)

2 DISTRIBUTION AND ECOLOGY

2.1 Delimitation of the total area of distribution and ecological characterization of this area

2.2 Ecological requirements

- Level
- Substratum
- Temperature
- Illumination
- Turbulence

2.3 Ecological determinants of the general limits of distribution and of the variations of these limits and of differential distribution

1/ Prepared by: Professor Jean Feldmann, Laboratoire de Biologie Végétale Marine, Faculté des Sciences, Université de Paris

3 BIONOMICS AND LIFE HISTORY

3.1 Reproduction

3.1.1 Sexuality (hermaphroditism, heterosexuality, intersexuality)
3.1.2 Maturity (age and size)
3.1.3 Fecundity
- Relation of gametes and spores size and number to plant size and to age

3.1.4 Spores or gametes liberation
- Fruiting seasons (beginning, end, peak)
- Number of spores or gametes emissions per year, frequency
- Emission time of day
- Tides relations with emission
- Induction of emission, artificial fertilization (?)

3.1.5 Spores and zygotes development
- Type of germination
- Growth speed
- Development period
- Ecological requirements
- Grazers and parasites

3.2 Life cycle

3.2.1 Alternation of generations
3.2.2 Nuclear phases

3.3 Life history

3.3.1 Sporophyte
- Annual cycle - life form
- Longevity
- Hardiness
- Competitors
- Grazers
- Parasites and diseases
- Greatest size

3.3.2 Gametophyte
-
-
-
- idem ut supra
-
-
-

3.4 Nutrition and growth

3.4.1 Mineral substances and trace elements required
3.4.2 Factors affecting the rate of photosynthesis and photosynthesis itself
3.4.3 Required growth-substances and organic nutrition
3.4.4 Relative and absolute growth patterns and rates
3.4.5 Relation of growth to environmental factors such as temperature and light

4 POPULATION (STOCK)

4.1 Structure

4.1.1 Sex ratio and sporophyte-gametophyte ratio
4.1.2 Age composition
4.1.3 Size composition

4.2 Size and density

4.2.1 Average size
4.2.2 Changes in size
4.2.3 Average density of population
4.2.4 Changes in density of population

4.3 Mortality, morbidity

4.3.1 Mortality, morbidity
4.3.2 Effect of harvesting

4.4 Dynamics of population

4.5 Relation of population to community and ecosystem, biological production, etc.

5 EXPLOITATION*

5.1 Harvesting equipment

5.1.1 Harvesting gear
5.1.2 Harvesting boats

5.2 Harvesting areas

5.2.1 General geographic distribution
5.2.2 Geographical ranges (latitudes, distances from coast, etc.)
5.2.3 Depth ranges

5.3 Harvesting seasons

5.3.1 General pattern of harvesting season
5.3.2 Duration of harvesting season
5.3.3 Dates of beginning, peak and end season
5.3.4 Variation in time or duration of harvesting season
5.3.5 Factors affecting harvesting season

5.4 Harvesting operations and results

5.4.1 Effort and intensity
5.4.2 Selectivity
5.4.3 Harvest
5.4.4 Past and present factors of effect on operations and results

5.5 Harvesting management and regulations

5.6 Culturing, transplanting and other intervention

6 CHEMICAL COMPOSITION

6.1 Water content

6.2 Mineral constituents

6.3 Organic constituents

6.3.1 Cell wall constituents (i.e. agar, alginic acid, etc.)
6.3.2 Pigments
6.3.3 Vitamins
6.3.4 Other cell constituents (i.e. carbohydrates, proteins, etc.)

6.4 Variations in chemical composition

6.4.1 Seasonal variations
6.4.2 Geographical variations
6.4.3 Variations according to the environment

7 UTILISATION

7.1 Food

7.2 Agriculture

7.3 Industry including industrial processing in the field and factory

*Only information of relevance for the understanding of the biology of the species and effect of exploitation on the stocks should be considered.

OUTLINE FOR SYNOPSIS OF DATA ON SPECIES AND STOCKS (WHALES)[1/]

1 IDENTITY

1.1 Taxonomy

1.11 Definition
1.12 Description

1.2 Nomenclature

1.21 Valid scientific names
1.22 Synonyms
1.23 Standard common name(s), vernacular names

1.3 Variability

1.31 Sexual dimorphism
1.32 Subspecific fragmentation
1.33 Genetic data

2 DISTRIBUTION

2.1 Total area
2.2 Differential distribution
2.3 Determinants of distributional changes

3 BIONOMICS AND LIFE HISTORY

3.1 Reproduction

3.11 Reproductive anatomy
3.12 Breeding season
3.13 Oestrous cycles
3.14 Ovulation
3.15 Fertilization
3.16 Implantation
3.17 Placentation and embryology
3.18 Gestation
3.19 Parturation
3.110 Litter size
3.111 Lactation

1/ Prepared by: Dr. G. Chittleborough, CSIRO Reg. Lab., Nedlands, Perth, Australia

3.2 Juvenile life

3.21 Description of newborn
3.22 Suckling and growth
3.23 Weaning: age, size, weight: duration of weaning
3.24 Food and feeding after weaning
3.25 Parental care
3.26 Neonatal and juvenile mortality
3.27 Maturity
Age
Length

3.3 Adult life

3.31 Food, feeding and nutrition
Food
Nutrition
3.32 Metabolism: endocrines and hormones
3.33 Growth
Relative growth
Absolute growth
Maximum length
Weight
3.34 Predators
3.35 Competitors
3.36 Symbionts, commensals and associates
3.37 Parasites, diseases, injuries and abnormalities
3.38 Courtship and breeding behaviour
3.39 Mating
3.310 Breeding frequency
3.311 Migration, roguing and territorial behaviour
3.312 Responses to stimuli
Temperature
Sound
Lunar cycle
3.313 Longevity, senility and natural mortality

4 POPULATION(S)

4.1 Population structure

4.11 Sex ratio
4.12 Age composition
4.13 Size composition

4.2 Density of stocks

4.21 Density
4.22 Changes in density

4.3 Recruitment

4.31 Birth rate
4.32 Factors affecting birth rate
4.33 Rates of survival to adulthood
4.34 Immigration

4.4 Population loss

4.41 Annual mean mortality rates (adults)
4.42 Changes in mortality rates
4.43 Emigration

4.5 Population assessment

4.51 Population size
4.52 Changes in population size
4.53 Yield equation: sustainable yield

5 MANAGEMENT AND EXPLOITATION

5.1 Fishing equipment

5.2 Fishing areas

5.3 Fishing seasons

5.4 Fishing operations and results

5.5 Regulations

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(64) Allsopp, W.H.L.
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Synopsis of biological data on the Sacramento squawfish Ptychocheilus grandis (Ayres) 1854

(67) ----------
Synopsis of biological data on the tui chub Siphateles bicolor (Girard) 1856

(68) ----------
Synopsis of biological data on the greaser blackfish Orthodon microlepidotus (Ayres) 1854

(69) ----------
Synopsis of biological data on the Sacramento hitch Lavinia e. exilicauda Baird and Girard 1854

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Synopsis of biological data on barracouta Leionura atun (Euphrasen) 1791

(71) CSIRO, Australia
Synopsis of biological data on Australian salmon Arripis trutta

(72) CSIRO, Australia
Synopsis of biological data on marine crayfish Jasus lalandei

(73) CSIRO, Australia
Synopsis of biological data on morwong Nemadactylus macropterus

(74) CSIRO, Australia
Synopsis of biological data on tiger flathead Neoplatycephalus richardsoni

(75) Bougis, P.
Synopsis of biological data on red mullet Mullus surmuletus Linnaeus 1758, stripped mullet M. barbatus Linnaeus 1758 and related genera and species

(76) Lee J.Y.
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(81) Edwertowski, J.
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Synopsis of biological data on soft-shell clam Mya arenaria Linnaeus BCF, USFWS

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(89) Reintjes, J.W.
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1/ In preparation for the FAO World Scientific Meeting on the Biology and Culture of Shrimps and Prawns

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Synopsis of biological data on sea bob Xiphopenaeus kroyeri (Heller) 1862

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Synopsis of biological data on common prawn Palaemon serratus (Pennant) 1777

(103)[1/] Simpson, A.C.
Synopsis of biological data on pink shrimp Pandalus montagui Leach 1814

(104) Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service
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(105) Thomas, H.J. and M.J. de Figueiredo
Synopsis of biological data on Norway lobster Nephrops norwegicus (Linnaeus) 1758

(106)[2/] _____
Synopsis of biological data on common carp Cyprinus carpio Linnaeus 1758

(107)[2/] _____
Synopsis of biological data on catla Catla catla (Hamilton Buchanan)

(108)[2/] _____
Synopsis of biological data on tilapia Tilapia mossambica Peters

(109) Deelder, C.L.
Synopsis of biological data on European eel Anguilla anguilla Linnaeus 1758

(110) _____
Synopsis of biological data on Atlantic salmon Salmo salar (Linnaeus) 1758

1/ In preparation for the FAO World Scientific Meeting on the Biology and Culture of Shrimps and Prawns.

2/ To serve as background papers for the FAO World Symposium on Warm-water Pond Fish Culture to be held in Rome in May 1966. Mr. K. H. Alikunhi, Director, Central Inland Fisheries Research Institute, Bombay, will cover the data on common carp relating to Asia and the Far East and Mr. S. Sarig, Chief, Laboratory of Fish Diseases, Nir-David, D.N., Israel, the rest of the world. Efforts are being made to find authors for the synopses on catla and tilapia.

IV COLLABORATION WITH OTHER ORGANIZATIONS

European Inland Fisheries Advisory Commission (EIFAC)

The preparation of synopses by scientists of the member countries of EIFAC is progressing very satisfactorily and a number of synopses have been or are being prepared as listed in Section III. (Nos. 21, 22, 23, 62, 90, 91, 92, 109, 110) Editing and publication of the synopses is done by FAO.

Division of Fisheries and Oceanography of the Commonwealth Scientific and Industrial Research Organization of Australia (CSIRO), and other Institutions

The agreement established with the Division of Fisheries and Oceanography of CSIRO by which the Division would initiate the publication of synopses prepared following the FAO outline and format is now in operation. A Synopsis of Biological Data on the Grey Mullet Mugil cephalus Linnaeus 1758 prepared by J. M. Thomson has been issued accordingly, as the first number of the CSIRO species synopsis series. Others are in preparation. (See Section III, Nos. 20, 70, 71, 72, 73, 74, 77, 78)

CSIRO is also planning to prepare synopses on western crayfish (Panulirus cygnus) and on Australian species of prawns.

The Australian Mammalogical Society plans to modify the FAO synopsis outline to suit the assembly of information on mammals and to proceed with arrangements for preparation of such synopses.

The Victoria Department of Fisheries and Wildlife is planning to prepare synopses on the species being studied by the Department.

The Australian Marine Sciences Association has discussed the use that it might make of the FAO synopses outline in the preparation of monographs on Australian marine fauna and flora, and has also discussed the possibility of drawing on the synopsis concept in the preparation of accounts of communities which might be the object of field studies in undergraduate courses.

Dr. D. McMichael, Curator of Molluscs at the Australian Museum, is assembling material in collaboration with workers from other institutions for the preparation of a synopsis on an important Australian mollusc.

Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service

An agreement has been established with the Bureau of Commercial Fisheries by which its various biological laboratories will prepare synopses on species of aquatic resources of their concern, following the FAO outline, to be published by the Bureau in its Special Scientific Report —— Fisheries Series. Several synopses are now being prepared. (See Section III, Nos. 84, 85, 86, 87, 88, 89, 95, 96, 97, 104)

Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service

Although collaboration has been established with the Sandy Hook Marine Laboratory to prepare synopses on the biology of species of sport fishes no official arrangement has yet been made for the publication of those synopses. The "North Central Reservoir Investigations" of this Bureau has also shown interest in preparing synopses on various reservoir species (See Section III, Nos. 65, 80)

It is planned to approach the Director of the Bureau with a view to establishing an agreement similar to that of the Bureau of Commercial Fisheries.

International Phycological Society

Although various algologists have shown interest in preparing synopses on the biology of seaweeds of economic value following the FAO outline adapted to the biology of plants (see pages 31 - 34) by Professor Jean Feldmann of the Laboratoire de Biologie VégétaleMarine, Faculté des Sciences, Université de Paris, no synopses have yet been completed on species of seaweeds and no operational agreement has been established with the International Phycological Society.

International Council for the Exploration of the Sea (ICES)

The Gadoid Fish Committee of the ICES agreed to revise a Synopsis of Biological Data on Cod Gadus morhua Linnaeus 1758 prepared by J. P. Wise (see Section III, No. 2) and set up a "Working Group on Revision of the FAO Synopsis of Biological Data on the Cod". The members of the group are: J. Corlett (U.K.) Convener, A. Hylen (Norway), J. Jonsson (Iceland), V. S. Prokhorov (U.S.S.R.) and U. Schmidt (Germany).

International Commission for the Northwest Atlantic Fisheries (ICNAF)

A Working Group has been set up by ICNAF to draft a synopsis on the biology of haddock. (See Section III, No. 82) The members of the Group are: H. W. Graham (U.S.A.), A. S. Bogdanov (U.S.S.R.), J. Hart (Canada), W. Templeman (Canada) and C. E. Lucas (U.K.).

General Fisheries Council for the Mediterranean (GFCM)

Cooperation has been established with scientists of the countries members of the GFCM and synopses on some of the species found in the Mediterranean have been prepared. (See Section III, Nos. 24, 25) Editing and publication of the synopses is done by FAO.

Cooperative Study of the Kuroshio and Adjacent Regions (CSK)

The Meeting of the International Coordinating Group for the Cooperative Study of the Kuroshio and Adjacent Regions convened in Manila, Philippines, from 8 to 11

February 1965, "noted with appreciation the development of the FAO program of synoptic studies of commercially important species and groups of aquatic organisms". It selected ten items; squid, anchovy, saury, Pneumatophorus and Scomber, yellowtail (Seriola spp.), croakers (Pseudosciaena spp.), red snappers (Lutjanus sanguinus) or golden thread (Nemipterus spp.) and lizard fish (Saurida tumbil) as being species of major significance in the region, and requested FAO to explore the possibility of incorporating these items in its projected list of synopses, and if possible give high priority to them.

Arrangements are being initiated with fisheries institutions of the interested countries of the region to prepare and publish synopses on the biology of those species.

V FAO WORKING PARTY ON SPECIES SYNOPSES

The FAO Advisory Committee on Marine Resources Research (ACMRR) at its third session noted that the project to arrange for the compilation and publication of synopses of data on the biology of important species and stocks was proceeding successfully, especially through the co-operation with regional fisheries bodies (EIFAC, ICES, ICNAF, GFCM), the stimulus given by FAO's World Scientific Meetings on the Biology of Species of Commercial Importance and the parallel activities of certain national agencies. (CSIRO and the U.S. Bureau of Commercial Fisheries) The interest in this project was re-affirmed by an expression of the need for synopses of certain species at the meeting of the International Co-ordinating Group for the Co-operative Study of the Kuroshio and Adjacent Regions. (CSK)

Consideration was given by the Committee to the suggestion that some form of continuing body be established to promote this work, and it recommended that FAO consider the possibility of establishing a Working Party, with representatives from co-operating institutions and organizations, which would have the function of co-ordinating efforts of this kind, working to encourage participation of other bodies and also of acting as an editorial, control board. This Working Party should establish priorities.

According to this recommendation FAO is taking action to set up the Working Party.

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APPENDIX I

GEOGRAPHIC CLASSIFICATION AND CODES[1/]

Land Areas Code - Key to first digits

Land Areas - Three Digit Code

Land Areas - Alphabetic Key to three digit code

Water Areas - Letter Code (see map for boundaries)

Figure 1 - Marine Areas

(Up to date version of Geographic Classification and Codes from FAO Current Bibliography for Aquatic Sciences and Fisheries)

APPENDIX I

GEOGRAPHIC CLASSIFICATION AND CODES

Land Areas Code - Key to first digits

1. AFRICA
2. N. AMERICA
3. LATIN AMERICA (S. and Central America)
4. ASIA (excl. U.S.S.R.)
5. EUROPE (incl. Asia Minor; excl. U.S.S.R.)
6. OCEANIA
7. UNION OF SOVIET SOCIALIST REPUBLICS (U.S.S.R.)
8. SPECIAL INTERCONTINENTAL REGIONAL GROUPINGS

Land Areas - Three Digit Code

100 AFRICA
110 Northwestern Area
111 Tunisia
112 Algeria
113 Morocco
114 Sp. Possessions in N. Africa, Tangier, Canary Is.
115 Sp. Sahara. Ifni
120 Northeastern Area
121 Libya
122 UAR, Southern Region (Egypt)
123 Sudan
124 Eritrea
125 Ethiopia
126 Fr. Somaliland
127 Socotra I.
128 Republic of Somalia
130 Eastern Central Area
131 Republic of Kenya
132 Uganda
133 Republic of Tanzania
135 Seychelles
136 Mauritius
140 Western Central Area
141 Republic of Mali. Republic of Senegal. Islamic Republic of Mauritania. Republic of the Ivory Coast. Republic of Dahomey. Republic of Upper Volta. Republic of Niger. Cameroon, Federated State of East. Republic of Guinea
142 Cape Verde Is. Port. Guinea
143 Liberia
144 Gambia. Sierra Leone. Ghana. Br. Togoland. Fr. Togoland
145 Nigeria. Cameroon, Federated State of West
146 Gabon. Republic of Tchad. Congo (Brazzaville). Central African Republic
147 Congo (Leopoldville). Burundi. Rwanda
148 Sp. Guinea. São Tomé and Principe
150 Southern Area
151 Angola. Cabinda
152 S.W. Africa
153 St. Helena. Ascension. Tristan da Cunha
154 Republic of S. Africa. Basutoland. Swaziland
155 Mozambique
156 Malagasy Republic (Incl. Island of

S. Marie). Comoro Is. Reunion
157 Malawi and Southern Rhodesia
158 Bechuanaland
160 "Is. of S. Indian Ocean"
161 Prince Edward and Marion Is. (S.A.)
162 Bouvet I. (Norw.)
163 New Amsterdam and St. Paul Is.
164 Crozet I.
165 Kerguelen I. (Fr.)
166 Heard and McDonald Is. (Austr.)
180 Ethiopean Zoogeographical Region

200 N. AMERICA
208 Nearctic Zoogeographical Region
210 Canada
211 Yukon. Northwest Territories. 'Canadian Arctic'
212 British Columbia
213 Alberta. Saskatchewan. Manitoba
214 Ontario
215 Quebec
216 Newfoundland and Labrador. St. Pierre and Miquelon
217 New Brunswick. Nova Scotia. Prince Edward I.
220 USA (Alaska)
222 Aleutian Is.
223 Pribilof Is.
230 United States of America
District of Columbia
231 Northwestern States:
Washington State, Oregon, Idaho
232 Southwestern States:
California, Nevada, Utah, Arizona
233 Western Central States:
Montana, Wyoming, Colorado
234 Eastern Central States:
N. and S. Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Kentucky, Ohio, W. Virginia
235 Southern States:
New Mexico, Oklahoma, Texas, Arkansas, Louisiana, Tennessee, Mississippi, Alabama
236 New England:
Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island
237 Middle Atlantic States:
New York, New Jersey, Maryland, Virginia, Pennsylvania, Delaware
238 Southern Atlantic States:
N. and S. Carolina, Georgia, Florida
240 Bermudas
250 Greenland

300 LATIN AMERICA
308 Neotropical Zoogeographical Region
310 Central America (Mainland)
311 Mexico
312 Guatemala
313 El Salvador
314 Costa Rica
315 Panama
316 Nicaragua
317 Honduras
318 Br. Honduras
320 Caribbean Is.
321 Br. Caribbean Federation, Bahamas
322 Cuba
323 Haiti
324 Dominican Republic
325 Puerto Rico. Virgin Is. (U.S.) Swan Is.
326 Guadeloupe. Martinique
327 Neth. W. Indies
330 Northern S. America
331 Colombia
332 Venezuela
333 Br. Guiana
334 Surinam
335 Fr. Guiana
340 Western S. America
341 Ecuador (Incl. Galapagos Is.)
342 Peru
343 Chile
350 Eastern S. America
351 Brazil

352 Uruguay
353 Argentina
354 Falkland Is.
355 Bolivia
356 Paraguay

400 ASIA
410 S.W. Asia
411 Syrian Arab Republic. Lebanon
412 Cyprus
413 Israel
414 Jordan
415 Saudi Arabia. Yemen. Aden Colony and Protectorate. Muscat and Oman. Trucial Oman. Kuwait. Bahrein. Qatar
416 Iraq
417 Iran
418 Afghanistan
420 Central Area
421 Pakistan (whole country, or W. Pakistan only)
422 Jammu and Kashmir
423 India (Incl. Laccadive and Andaman Is.). Sikkim
424 Ceylon (Incl. Maldive Is.)
425 E. Pakistan
426 Nepal. Bhutan
430 Southeastern Area
431 Burma
432 Thailand
433 Malaysia. Singapore. Cocos and Keeling Is.
434 Borneo. Celebes. Indonesia. Java. Molucca Is. Sumatra. Port. Timor
435 West New Guinea (West Irian)
436 Br. Borneo (Incl. Brunei, Sarawak, N. Borneo)
437 Philippines
438 Cambodia. Indochina. Vietnam. Laos
440 Eastern Area (Mainland)
441 Chinese People's Republic (Incl. Tibet, Manchuria and Sinkiang)
442 Hong Kong
443 Macau
444 Korea
445 Mongolian People's Republic
450 Eastern Area (Is.)
451 Japan
452 Ryukyu Is.
453 Formosa
454 Bonin Is. Volcano Is.
480 Oriental Zoogeographical Region (420 and 430 except 434/6)

500 EUROPE
510 Scandinavia
511 Denmark
512 Faroe Is.
513 Iceland
514 Norway
515 Svalbard. Bear I. Jan Mayen
516 Sweden
517 Finland
520 Western Area (Mainland)
521 Netherlands
522 Belgium
523 Luxembourg
524 France
525 Monaco
530 British Isles
531 Ireland
532 United Kingdom
533 England, Wales
534 Scotland (Orkneys, Shetlands, Hebrides)
535 Northern Ireland
536 Channel Is.
537 I. of Man
540 Southern Area
541 Portugal. Azores. Madeira
542 Spain. Balearic Is. Andorra
543 Italy
544 San Marino
545 Holy See
546 Corsica
547 Malta and Gozo
548 Gibraltar
550 Southeastern Area
551 Yugoslavia
552 Albania
553 Greece

554 Bulgaria
555 Roumanian People's Republic
556 Turkey
560 Western Central Area
561 German Federal Republic (Also Germany as a whole)
562 Switzerland. Liechtenstein
563 Austria
570 Eastern Central Area
571 Eastern Germany
572 Poland
573 Czechoslovakia
574 Hungary

600 OCEANIA
608 Australian Zoogeographical Region
610 Australia
611 Northern Territory
612 Western Australia
613 S. Australia
614 Victoria
615 New S. Wales
616 Queensland
617 Tasmania
618 Norfolk I. Macquarie I.
620 New Guinea Trust Territory (Austr.) Papua
621 N.E. New Guinea
622 Bismarck Archipelago
623 Bougainville I. Solomon Is. (Austr.)
624 Papua
630 New Zealand
631 N. and S. Is.
632 Cook Is.
633 Kermadec Is.
634 Campbell I.
635 Niue I.
636 Tokelau Is.
637 Chatham, Bounty, Antipodes, Auckland Is.
640 Eastern Oceania
641 Fr. Oceania
643 Pitcairn
650 Line Is.
651 Christmas I.
652 Palmyra. Jarvis. Howland. Canton and Enderbury Is. (U.S.)
660 USA (Hawaii)
661 Midway I.
662 Johnston I.
670 Pacific Is. Strategic Trust Territory Guam. Wake I.
671 Marianas Is.
672 Palau Is.
673 Caroline Is.
674 Marshall Is.
676 Guam
677 Wake I.
680 Central Groups
681 Br. Solomon Is. (May also incl. 623)
682 New Caledonia
683 New Hebrides
684 Fiji. Tonga
685 U.S. Samoa Western Samoa Trust Territory
686 Phoenix Is.
687 Gilbert and Ellice Is.
688 Nauru I.

700 UNION OF SOVIET SOCIALIST REPUBLICS
710 Russian Federated S.S.R.
716 Soviet Is. in Arctic Ocean: Novaya Zemlya, Franz Josef Land, Severnaya Zemlya, Novosibirskiye Ostrova
720 Karel S.S.R. (Finno-Karelia)
730 Baltic Republics
731 Estonian S.S.R.
732 Latvian S.S.R.
733 Lithuanian S.S.R.
740 Byelorussian S.S.R.
750 Southwestern Republics
751 Ukrainian S.S.R.
752 Moldavian S.S.R.
760 Caucasian Republics
761 Georgian S.S.R.
762 Armenian S.S.R.
763 Azerbaijan S.S.R.
770 Southern Republics
771 Turkmen S.S.R.
772 Uzbek S.S.R.
773 Tadzhik S.S.R.
77 Kirgiz S.S.R.
780 Kazakh S.S.R.

800 SPECIAL INTERCONTINENTAL REGIONAL GROUPINGS

810 Hemispheres and Climatic Zones
811 Northern Hemisphere
812 Southern Hemisphere
813 Western Hemisphere
814 Eastern Hemisphere
815 Polar Regions
816 Temperate Zones
817 Tropics
820 Antarctic Continent
860 Non-Self-Governing Territories
861 Br. Commonwealth
862 U.S. Administration
863 Fr. Community
864 Belg. Administration
865 Sp. Administration
866 Port. Administration
867 Neth. Administration
868 International Administration
880 Zoogeographical Regions (other than 180, 208, 308, 480, 608)
881 Holarctic Realm

Land Areas - Alphabetic Key to three digit code

Abkhaz S.S.R.	761	Argentina	353
Adelie Land	820	Arizona	232
Aden Colony and Protectorate	415	Arkansas	235
Adghar S.S.R.	761	Armenian S.S.R.	762
Admiralty Is.	622	Aruba	327
Aegean Is.	553	Ascension	153
Afghanistan	418	Auckland Is.	637
Alabama	235	Austral Is.	641
Alaska	220	Australia	610
Albania	552	Australia, Northern Territory	611
Alberta	213	Australia, Southern	613
Aleutian Is.	222	Australia, Western	612
Algeria	112	Australian Zoogeographical Region	608
Alhucemas	114	Austria	563
Am. Samoa	685	Azerbaijan S.S.R.	763
Amur	710	Azores	541
Anatolia	556		
Andaman Is.	423		
Andorra	542	Baffin I.	211
Angola	151	Bahama Is.	321
Anguilla	321	Bahrein (al-Bahrayn)	415
Annobon	148	Balearic Is.	542
Antarctic Continent	820	Bali I.	434
Antigua	321	Baluchistan (Pakistan)	421
Antilles (Br.)	321	Baluchistan (Iran)	417
Antilles (Neth.)	327	Barbados	321
Antipodes Is.	637	Basutoland	154
Arabia	415	Bear I.	515
Archangelsk	710	Bechuanaland	158

Belg. Administration	864
Belgium	522
Bermuda	240
Bhutan	426
Bismarck Archipelago	622
Bolivia	355
Bonaire	327
Bonin Is.	454
Borneo, N. (Br.)	436
Borneo (Indonesia)	434
Bougainville I.	623
Bounty Is.	637
Bouvet I. (Norw.)	162
Brazil	351
Britain, Great	532
Br. Borneo	436
Br. Caribbean Federation	321
British Columbia	212
Br. Commonwealth	861
Br. Guiana	333
Br. Honduras	318
Br. Isles	530
Br. Solomon Is.	681
Br. Togoland	144
Br. W. Indies	321
Brunei	436
Bulgaria	554
Burma	431
Buryat-Mongol A.S.S.R.	710
Byelorussian S.S.R.	740
Cabinda	151
Caicos Is.	321
California	232
Cameroons	141/145
Cambodia	438
Campbell I.	634
Canada	210
Canadian Arctic	211
Canadian N.W. Territories	211
Canadian Pacific Coast	212
Canary Is.	114
Canberra	610
Canton I. (U.S.)	652
Cape Province	154
Cape Verde Is.	142
Caribbean Is.	320
Caroline Is.	673
Caucasian Republics	760
Cayman Is.	321
Celebes	434
Central African Republic	146
Central America (Mainland)	310
Central Polynesian Sporades	650
Ceram	434
Ceuta	114
Ceylon	424
Chad (see Tchad)	146
Chafarinas	114
Chagos archipelago	135
Channel Is.	536
Chatham Is.	637
Chile	343
China (Formosa)	453
Chinese People's Republic	441
Chita	710
Christmas I.	651
Coats Land	820
Cocos Is.	433
Colombia	331
Colorado	233
Comoro Is.	156
Congo	146/147
Congo (Brazzaville)	146
Congo (Leopoldville)	147
Connecticut	236
Cook Is.	632
Corsica	546
Costa Rica	314
Crete	553
Crimea	710
Crown Prince Olaf Land	820
Crown Princess Martha Land	820
Crozet I.	164
Cuba	322
Curacao	327
Cyprus	412
Cyrenaica	121
Czechoslovakia	573
Dahomey, Republic of	141
Dakar	141
Dakota, N. and S.	234

Delaware 237
Denmark 511
District of Columbia (U.S.A.) 230
Dodecanese Is. 553
Dominica 321
Dominican Republic 324

E. Africa (Port.) 155
E. Indies 434/7
Eastern Hemisphere 814
E. Germany 571
E. Pakistan 425
Ecuador 341
Egypt 122
Ellice I. 687
El Salvador 313
Enderbury I. 652
Enderby Land 820
England 533
Eritrea 124
Er-Rif 114
Estonian S.S.R. (Estonia) 731
Ethiopia 125
Ethiopean Zoogeographical Region: (13/15, 123 and 416 (S.)) 180

Falkland Is. 354
Falkland Is. Dependencies 820
Faroe Is. 512
Fernando Po 148
Fiji 684
Finland 517
Florida 238
Formosa 453
France 524
Franklin District (Canada) 211
Franz Josef Land 716
Fr. Community 863
Fr. Guiana 335
Fr. Oceania 641
Fr. Somaliland 126
Fr. Togoland 144

Gabon (Gabonese Republic) 146
Galapagos Is. 341
Gambia 144
Georgia (U.S.A.) 238
Georgian S.S.R. (Georgia) 761
German Democratic Republic (Germany, E.) 571
German Federal Republic (Germany, W.) 561
Germany 561
Gibraltar 548
Gilbert Is. 687
Gozo 547
Graham Land (Palmer Peninsula) 820
Great Britain 532
Greater Antilles 320
Greece 553
Greenland 250
Grenada 321
Guadeloupe 326
Guam 676
Guatemala 312
Guernsey 536
Guiana (Br.) 333
Guiana (Fr.) 335
Guiana (Neth.) 334
Guinea, Republic of 141
Guinea, Port. 142
Guinea, (Sp.) 148
Guyane 335

Haiti 323
Hawaii 660
Heard I. (Austr.) 166
Hebrides 534
Hemispheres: eastern 814
northern 811
southern 812
western 813
Hispaniola 323/4
Hokkaido 451
Holarctic Realm 881
Holy See 545
Honduras 317
Hong Kong 442
Honshu 451
Howland I. 652
Hungary 574

Iceland 513
Idaho 231
Ifni 115
Illinois 234
India 423
Indiana 234
Indochina 438
Indonesia 434
Inini 335
Inner Mongolia 441
International Administration 868
Ionian Is. 553
Iowa 234
Iran 417
Iraq 416
Ireland, Northern 535
Ireland, Republic of 531
Irkutz 710
Is. of S. Indian Ocean 160
I. of Man 537
Israel 413
Italy 543
Ivory Coast, Republic of 141

Jamaica 321
James W. Ellsworth Land 820
Jammu 422
Jan Mayen 515
Japan 451
Jarvis I. 652
Java 434
Jersey 536
Johnston I. 662
Jordan 414

Kaiser Wilhelm II Land 820
Kamchatka 710
Kansas 234
Kara-Kalpak S.S.R. 772
Karel S.S.R. (Finno-Karelia) 720
Kazakh S.S.R. (Kasakhstan) 780
Keewatin District (Canada) 211
Kemp Land 820
Kentucky 234
Kenya 131
Kerguelen I. (Fr.) 165
Kermadec Is. 633
Khabarovsk 710
King Edward VII Land 820
King George V Land 820
Kirgiz S.S.R. 774
Korea 444
Krasnoyarsk 710
Kuria-Muria Is. 415
Kurile Is. 710
Kuwait (al-Kuwayt) 415
Kyushu 415

Labrador 216
Laccadive Is. 423
Laos 438
Lappland 514, 516/7
Latin America 300
Latvian S.S.R. (Latvia) 732
Lebanon 411
Leeward Is. (Br.) 321
Leeward Is. (Neth.) 327
Lesser Antilles 321, 325/7
Liberia 143
Libya 121
Liechtenstein 562
Line Is. 650
Lithuanian S.S.R. (Lithuania) 733
Lombok I. 434
Lord Howe I. 618
Louisiana 235
Loyalty Is. 682
Luxembourg 523

Macau 443
McDonald I. (Aust.) 166
Macedonia 551/553
McKenzie District (Canada) 211
Macquarie I. (Aust.) 618
MacRobertson Land 820
Madeira 541
Maine 236
Malagasy Republic 156
Malawi 157
Malaysia 433

Maldive Is. 424
Malta 547
Manchuria 441
Manitoba 213
Marianas Is. 671
Marie Byrd Land 820
Marion I. (S. Africa) 161
Marquesas Is. 641
Marshall Is. 674
Martinique 326
Maryland 237
Massachusetts 236
Mauritania, Islamic Republic of 141
Mauritius 136
Melilla 114
Mergui Archipelago 431
Mexico 311
Michigan 234
Middle Congo 146
Midway I. 661
Minnesota 234
Miquelon 216
Mississippi 235
Missouri 234
Moldavian S.S.R. 752
Moluccas 434
Monaco 525
Mongolia, Inner 441
Mongolian People's Republic (Outer Mongolia) 445
Montana 233
Montserrat 321
Morocco 113
Mozambique 155
Murmansk 710
Muscat 415

Nagorno Karabakh S.S.R. 763
Nakhichevan S.S.R. 763
Natal 154
Nauru 688
Nearctic Zoogeographical Region 208
Nebraska 234
Neotropical Zoogeographical Region 308
Nepal 426
Netherlands 521
Neth. Administration 867
Neth. Guiana 334
Neth. W. Indies (Neth. Antilles) 327
Nevada 232
New Amsterdam (Fr.) 163
New Britain 622
New Brunswick 217
New Caledonia 682
New England 236
Newfoundland 216
New Guinea 435/620/621
New Guinea (Neth.) 435
New Guinea, N.E. 621
New Guinea Trust Territory (Austr.) 620
New Hampshire 236
New Hebrides 683
New Ireland 622
New Jersey 237
New Mexico 235
New Siberian Is. 716
New South Wales 615
New York 237
New Zealand 630
New Zealand (N. and S. Is.) 631
Nicaragua 316
Nicobar Is. 423
Niger, Republic of 141
Nigeria 145
Niue 635
Non-Self-Governing Territories 860
Norfolk I. 618
N. America 200
N. Borneo (Br.) 436
N. Carolina 238
N. Dakota 234
N. Land 716
N.E. New Guinea 621
Northern Hemisphere 811
Northern Ireland 535
N.W. Territories of Canada 211
Norway 514
Nova Scotia 217

Novaya Zemlya 716
Novosibirskie Ostrova 716
Novosibirsk 710

Oates Land 820
Oceania 600
Ohio 234
Oklahoma 235
Oman 415
Omsk 710
Ontario 214
Orange Free State 154
Oregon 231
Oriental Zoogeographical Region 480
Orkney Is. 534
Outer Mongolia 445

Pacific. Is. Strategic Trust Territory (U.S. Adm.) 670
Pakistan E. 425
Pakistan, whole country or W. only 421
Palau Is. 672
Palmyra I. 652
Panama 315
Papua 624
Paraguay 356
Peloponnese 553
Pemba 133
Pennsylvania 237
Penon de Velez de la Gomera 114
Perim Is. 415
Peru 342
Pescadores Is. 453
Philippines 437
Phoenix Is. 686
Pitcairn I. Group 643
Poland 572
Polar Regions 815
Portugal 541
Port. Administration 866
Port. E. Africa 155
Port. Guinea 142
Port. Timor 434
Port. W. Africa 151
Prairie Provinces (Canada) 213
Pribilof Is. 223
Primorsk 710
Prince Edward I. (Canada) 217
Prince Edward I. (S. Africa) 161
Prince Harold Land 820
Princess Astrid Land 820
Princess Elizabeth Land 820
Princess Ragnhild Land 820
Principe 148
Puerto Rico 325

Qatar 415
Quebec 215
Queen Mary Land 820
Queen Maud Land (Norw.) 820
Queensland 616

Reunion 156
Rhode I. 236
Rhodesia 157
Rio de Oro 115
Rio Muni 148
Rodrigues 135
Ross Dependency (N.Z.) 820
Roumania 555
Russian Federated S.S.R. (Russia) 710
Rwanda 147
Ryukyu Is. 452

Saba 327
Saguia el Hamra 115
Sahara Sp. 115
St. Eustatius 327
St. Helena 153
St. Kitts-Nevio 321
St. Lucia 321
St. Martin 327
St. Paul I. (Fr.) 163
St. Pierre 216
St. Vincent 321
Sakhalin 710
Samoa, Am. 685
Samoa, Western, Trust Territory (N.Z.) 685
San Marino 544

Santa Cruz Is.	681	Surinam	334
São Tomé	148	Svalbard	515
Sarawak	436	Swan Is.	325
Sardinia	543	Swaziland	154
Saskatchewan	213	Sweden	516
Saudi Arabia	415	Switzerland	562
Scandinavia	510	Syrian Arab Republic	411
Scotland	534		
Senegal, Republic of	141	Tadzhik S.S.R. (Tadzhikistan)	773
Severnaya Zemlya	716	Tangier	114
Seychelles	135	Tanzania, Republic of	133
Shetland Is.	534	Tasmania	617
Siberia	710	Tchad, Republic of	146
Sicily	543	Temperate Zones	816
Sierra Leone	144	Tennessee	235
Sikkim	423	Texas	235
Singapore	433	Thailand	432
Singkiang	441	Thessaly	553
Society Is.	641	Thrace	553
Socotra I.	127	Tibet	441
Solomon Is. (Austr.)	623	Timor	434
Solomon Is. (Br.)	681	Tobago	321
Somalia	128	Togoland	144
Somaliland, Fr.	126	Tokelau Is.	636
S. Africa, Republic of	154	Tomsk	710
S. Carolina	238	Tonga	684
S. Dakota	234	Transcaucasia	760
Southern Hemisphere	812	Transvaal	154
Southern Rhodesia	157	Trinidad	321
S. Georgia I.	820	Tripolitania	121
S. Orkney Is.	820	Tristan da Cunha	153
S. Sandwich Is.	820	Tropics	817
S. Shetland Is.	820	Trucial Oman	415
S.W. Africa	152	Trust Territories	868
S.W. Asia	410	Tuamoto Archipelago	641
Soviet Is. in Arctic Ocean	716	Tubuai Is.	641
Spain	542	Tunisia	111
Sp. Administration	865	Tura	710
Sp. Guinea	148	Turkey	556
Sp. Possessions in N. Africa	114	Turkmen S.S.R. (Turkmenistan)	771
Sp. Sahara	115	Turks Is.	321
Spitzbergen	515	Tyumen	710
Subtropical Zones	817		
Sudan	123	Ubangi-Shari	146
Sumatra	434	Uganda	132
Sunda Is.	434	Ukrainian S.S.R. (Ukraine)	751

UAR Northern Region (Syria)	411
UAR Southern Region (Egypt)	122
Union Is.	636
United Kingdom	532
United States of America (U.S.A.)	230
USA (Hawaii)	660
USA (Alaska)	220
U.S. Administration	862
Upper Volta, Republic of	141
Uruguay	352
Utah	232
Uzbek S.S.R. (Uzbekistan)	772
Venezuela	332
Vermont	236
Victoria (Austr.)	614
Victoria I.	211
Victoria Land	820
Vietnam	438
Virginia	237
Virgin Is. (Br.)	321
Virgin Is. (U.S.)	325
Volcano Is.	454
Wake I.	677
Wales	533
Washington, State of	231
W. Africa (Br.)	144
W. Africa (Fr.)	144
W. Africa (Port.)	151
W. Germany	561
W. Indies	320
W. Indies (Br.)	321
W. Indies (Neth.)	327
W. Virginia	234
Western Hemisphere	813
Western Samoa Trust Territory (N.Z.)	685
Wilkes Land	820
Windward Is. (Br.)	321
Windward Is. (Neth.)	327
Wisconsin	234
Wyoming	233
Yakut A.S.S.R.	710
Yemen	415
Yugoslavia	551
Yukon	211

Water Areas - Letter Code (See Fig. 1 for boundaries)

A	ATLANTIC OCEAN
AN	Atlantic, N.
ANW	Atlantic, N.W.: Baffin B., Davis Strait, Hudson B., G. of St. Lawrence, G. of Maine, Chesapeake B., B. of Fundy
ANE	Atlantic, N.E.: White Sea, Barents Sea, Greenland Sea, North Sea, Baltic Sea, G. of Bothnia, G. of Finland, English Channel, Irish Sea, Norwegian Sea
AS	Atlantic, S.
	Atlantic, S.W.: G. of Mexico, Caribbean Sea
ASE	Atlantic, S.E.: B. of Biscay, Mediterranean Sea (Western and Eastern Mediterranean; Tyrrhenian, Aegean, Ionian, Adriatic Seas), Sea of Marmara, Black Sea, Sea of Azov, G. of Guinea
I	INDOPACIFIC OCEAN
IN	Pacific, N.: Japan Sea, Sea of Okhotsk, Bering Sea, G. of Alaska, Georgia Strait
IS	Tropical Indopacific
ISW	Indian Ocean: Red Sea, G. of Aden, Persian G., G. of Oman, Arabian Sea, B. of

	Bengal, Andaman Sea, Mozambique Channel
ISEW	Indopacific, Central: G. of Thailand, S. China Sea, G. of Tonkin, E. China Sea, Yellow Sea, Inland Sea of Japan, Philippine Sea, Sulu Sea, Celebes Sea, Java Sea, Molucca Sea, Banda Sea, Timor Sea, Arafura Sea, G. of Carpentaria, Bismarck Sea, Solomon Sea, Coral Sea
ISE	Pacific, S.E.: G. of California, G. of Panama
P	POLAR SEAS
PN	Arctic Ocean: N. Polar Basin, Kara Sea, Laptev Sea, E. Siberian Sea, Chuckchee Sea, Beaufort Sea
PS	Southern Ocean
PSW	Southern Ocean, W.
PSE	Southern Ocean, E.: Great Australian Bight, Tasman Sea
PSEW	S. Polar Seas: Scotia Sea, Weddell Sea, King Haakon VII Sea, Ross Sea, Roald Amundsen Sea, Bellingshausen Sea
L	INLAND SEAS AND INTER-TERRITORIAL LAKE SYSTEMS
L.11	East African Lakes: L. Rudolph, L. Edward, L. Albert, L. Kiyu, L. Victoria, L. Tanganyika, L. Nyassa, L. Moero
L.21	American Great Lakes: L. Nipigon, L. Superior, L. Michigan, L. Huron, L. Erie, L. Ontario
L.31	L. Titicaca
L.71	L. Ladoga
L.72	Caspian Sea
L.73	Aral Sea
L.74	L. Balkhash
L.75	L. Baikal

Fig. 1 MARINE AREAS

GOODE'S SERIES OF BASE MAPS
HENRY A. LEPPARD, EDITOR

C.677

APPENDIX II

NATURAL REGIONS OF THE OCEANS

Table I - Characteristics of Natural Regions of the Oceans

Table II - Groups of Natural Regions of the Oceans with Similar Environmental Conditions

Figure 2 - Natural Regions of the Oceans

TABLE I CHARACTERISTICS OF NATURAL REGIONS IN THE OCEANS

(Sheet I)

/1/ No.	/2/ Name of the Regions and Subregions (Waters).	/3/ Average Air Temperature °C (monthly average) Low	/3/ High	/4/ WINDS Prevailing Direction (from).	/5/ Resultant Force (Beaufort)	/6/ Frequency of gales and storms.	/7/ PRECIPITATION Annual Amount mm.	/8/ Main Season	/9/ Average Water Temperature °C (monthly average) Low	/9/ High	/10/ Average Surface Salinities °/oo	/11/ CURRENTS Prevailing Direction (from)	/12/ Average Speed (knots)	/13/ REMARKS (Oxygen, fertility, etc.)	/14/ Continental Shelf (Area and characteristics).
1.0	INDIAN OCEAN Monsoon Regions														
1.1	ARABIAN SEA REGION (with Red Sea and Persian Gulf)														
1.1.1	Red Sea (N and S parts)	20	32	Wi - NW/SE Su - NW	2 - 3	-	< 100	Wi	ca 20	> 30	40	Tidal		Oxygen minimum layer in ca 75 m depth. Transveral currents, caused by prevailing winds might cause slight upwelling in S part of the area. Moderate production.	Shelf rocky and corallime; relatively large in S part.
	Northern part	19	30	Wi - NW; Su - NW					20	28		Wi - SE Su - NW			
	Southern part	25	32.5	Wi - SE; Su - NW					25	32					
1.1.2	Persian Gulf	15	32.5	Wi - NE; Su - W	< 1	-	150	At	< 15	32.5	39	Tidal		No hydrographical investigations made in the area. NW part has probably moderate production.	Area 240,000 km² Av. depth 35 m. SE part very shallow; NE and N parts rocky.
1.1.3	Gulf of Aden	25	27.5	Wi - NE; Su - SW	1 - 2; 4 - 5	Wi -; Su +++	< 100	Wi	24	28	36	Wi - NE Su - SW	< 0.4 1	Oxygen minimum layer close to the surface (50 - 150 m). Upwelling on the W coast during the summer. Productive area. Stormy during the summer.	Narrow shelf. S part rocky.
1.1.4	Gulf of Oman	22.5	27.5	Wi - NW; Su - SW	< 1; 3 - 4	Wi -; Su +++	150	At	22	30	36.5	Wi - N Su - W	Weak < 0.5	See 1.1.3.	Very narrow shelf.
1.1.5	Central Arabian Sea	25	27.5	Wi - NE; Su - SW	3 - 4; 4 - 6	Wi -; Su +++	500	At	24	< 26	36	Wi - NE Su - SW	Weak 0.5	See 1.1.3. Productive in central part along the oceanic current divergences.	No shelf.
1.1.6	Laccadive Sea (Indian W coastal waters)	25	27.5	Wi - N.; Su - W	2 ; 2 - 3	-	> 1,500	Su	24	> 27	35.5	N	Wi - weak Su > 0.5	See 1.1.3. N part of the shelf productive.	Area 300,000 km² Average depth: NE part 20 m; S parts are rocky.
1.2	BAY OF BENGAL REGION														
1.2.1	Bay of Bengal	22.5	> 27.5	Wi - NE; Su - SW	2 ; 4	-	1,500	Su - At	24	> 28	33	Wi - SE Su - SW	1 0.5	Oxygen minimum layer in ca 150 m depth. Possibly slight local upwelling on W coast during summer. Moderate amount of nutrients in surface layers. N part has medium productivity.	Area 170,000 km² Average depth: N part 15 m; rest 50 - 100 m.
1.2.2	Andaman Sea	25	27.5	W. - N ; Su - SW	1 - 2; 3	Wi -; So +	2,500	Su	26	27	32	Wi - N Su - W	1 0.5	— . —	Area 380,000 km² Average depth 80m. Rocky and corallims. Low productivity.
1.3	INDIAN OCEAN NORTH EQUATORIAL CURRENT REGION														
1.3.1	Somali Waters	< 25	> 25	Wi - NE; Su - S	> 3 ; 3 - 6	Wi -; Su +++	300	Wi	23	27	35.5	Wi - NE Su - SW	< 1 2	Upwelling during the summer. Productive waters during this season.	
1.3.2	Indian Ocean N-Equatorial Current Waters	> 25	> 25	Wi - NE; Su - W	2 - 3	-	> 1,500	All year (Su)	27	28	35	Wi - E Su - W	< 0.5 > 0.5		
1.4	INDIAN OCEAN EQUATORIAL COUNTER CURRENT REGION	> 27.5	> 27.5	Wi - NW; Su - SE	< 1 ; 1 - 2	-	> 2,000	Su (all year)	26	> 28	34.5	W	Wi < 0.5 Su - weak	Slight upwelling along divergences and mixing on offshore grounds.	Offshore shelf; area 240,000 km² Average depth 40-80 m. Most shelves corralline. Medium productivity.
1.5	INDIAN OCEAN SOUTH-EQUATORIAL CURRENT REGION														
1.5.1	Mozambique Strait	> 27.5	> 25	Wi - E ; Su - SE	1 ; 2	-	1,000	Wi	21	28	35	N	1	Thick, nutrient-poor surface layer. Unproductive area.	Madagascar shelf 180,000 km²; 15 m deep. Zambesi shelf 50,000 km²; 90 m deep. Both rocky and coralline.
1.5.2	Indian Ocean S-Equatorial Current Waters	> 25	> 25	Wi - E ; Su - SE	3	++	2,000	Sp - Su	24	28	35	E	0.5	Unproductive area. With "old" surface waters.	

TABLE I (Sheet 11)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.5.3	North Australian Waters (included: Timor Sea and Arafura Sea)	27.5	27.5	Wi - W; Su - E	1 - 2; 2 - 3	-	1,500	Sp	26	> 28	34.5	Wi - SW Su - E	weak 0.5	Little investigated area. Low productivity.	Arafura Shelf 1.350,000 km² Average depth 70 m. Rocky and coralline. NW Australian Shelf 300,000 km² Average depth 80m.
1.5.4	Agulhas Waters	15	22	Wi - SE; Su - W	> 1 ; 5	Su +	700	(All year)	16	23	35.5	NE	Wi - 1.7 Su - < 1	Low productivity; area with warm surface water, flowing from Indian Ocean.	Area 110,000 km² Average depth 50 - 100 m. Irregular rocky bottom. Low productivity.
1.6	INDIAN OCEAN HORSE LATITUDE REGION														
1.6.1	Indian Ocean Southern Gyrals	15	23	Wi - SE; Su quiet	1 - 2; quiet	Wi ++; Su +	800	(Sp)	16	22	> 35.5	2 gyrals	Weak	Little investigated area. Low productivity oceanic area, with "old" surface waters. Slightly more production on the southern boundary (subtropical convergence).	
1.6.2	W Australian Waters	15	22.5	Wi - S ; Su - W	3 ; 3 - 4	Wi + ; Su -	500	Su	16	21	36	Wi - S; Su - E	<0.5; >0.5	Little investigated area.	
1.6.3	Great Australian Bight	>12.5	17.5	Wi - varying Su - W	3 - 4	Wi + Su ++	700	Su	12	18	> 35	Wi - E Su - W	Weak <0.5	Little investigated area. Medium productivity in the eastern part.	NW Australian shelf 350,000 km² Depth 40 - 130 m. Tasmanian Shelf 170,000 km² Depth 60 - 80 m. Productive.
2.0	WESTWIND DRIFT REGIONS														
2.1	INDO-PACIFIC WESTWIND DRIFT REGION	5	10	W	Wi - < - 5 Su - > 6	+ +++	> 1,000		5	10	34.5	W	>0.5		
2.2	ATLANTIC WESTWIND DRIFT REGION	8	12	W	Wi - 6 Su - 4	Wi + Su ++	> 1,000		5	10	34	W	>0.5	Area north of subantarctic convergence. Productive, especially in the southern boundary area.	New Zealand shelf 250,000 km² Depth 70 m. High productive, except S. part. Rocky.
2.2.1	Patagonian Waters	8	14	W	Wi <3 Su - 4	++	500	(Su)	7	15	33.5	Tidal (S)		Large, medium to high productive shelf area. Great seasonal variations.	Area 1,000,000 km² depth 80 - 100 m. Southern coast and SE part rocky.
2.3	ANTARCTIC NORTHERN REGION	- 2.5	2.5	NW	Wi - 4 - 5 Su - > 6	Wi ++ Su +++	1,000		- 0.5	2.5	34	SW		Never covered with pack ice. Important whaling area. Very productive.	
2.3.1	Area North of the Ross Sea	- 3	5	NW	6	+++	700		- 0.5	4	< 34	(SW)		Southern part covered with pack ice during northern summer. Whaling area. Productive.	
2.3.2	Scotia Sea and South Georgian Area	- 5	2	W	> 6	Wi +; Su +++	< 500		0	2	34	SW	Weak	Never covered with pack ice. Important whaling area. Very productive.	
2.4	ANTARCTIC INTERMEDIATE REGION	- 10	- 1.5	NE	4	+++	500		<- 1	- 1	< 34	(SW)		Largely covered by pack ice in northern summer and fall. Productive.	Weddell Shelf; unproductive.
2.4.1	Weddell Sea	- 16	- 2	NW	4 - 6	+++	< 250		<- 1	- 1	> 33.5	(Gyral(E))			
2.5	ANTARCTIC SOUTHERN REGION	- 25	- 5	E	Wi - 3 - 4 Su - > 6	Wi + Su +++	< 250		<- 1	<- 1	< 33.5	SE - E		Largely covered by pack ice throughout the year, with exception during the northern winter.	
3.0	ARCTIC REGION														
3.1	Kara Sea	- 25	5	(Wi - NE); (Su - SW)		Su -; Wi ++	< 250		<- 1	4	< 33			Largely covered with drift and pack ice, except during the summer.	
3.2	North Siberian Waters	(- 30)	(5)	(Wi - NE); (Su - SW)		Su +; Wi +++	< 25		<- 1	1	325	(W)		Largely covered with pack ice except along the coast short period in summer. Low productive.	North Siberian Shelf 2.600,000 km². Depth: W part 25 m; E part 40 m. Low productivity.
3.3	Chuktschee Sea	(- 30)	(6)	(Su - SE)		Su -; Wi ++	< 250		<- 1	1	< 33.5	(NW - E part) (SW - W part)		Largely covered with pack ice, except few months during late summer.	
3.4	High Arctic	(- 40)	(-2)				(< 250)		<- 1	<- 1				Covered with ice year around.	
4.1	KAMTCHATKA REGION														
4.1.1	Okhotsk Sea	- 15	12.5	Wi - S; Su - S	5; 1	Wi +; Su -	600	(All year AT)	<- 1	11	> 32	(N)	Weak	Productive shallow area with great seasonal changes.	Area 580,000 km² Depth 140 m. Productive.
4.1.2	Kamtchatka-Kurile Waters	- 8	12.5	Wi - S; (NE - NW) Su - S	6 1	Wi + Su +	> 1,000	At	0	12	32.5	NE	ca 0.5	Southerly flow of cold, dilute, nutrient rich water. Mostly ice-covered in winter.	Narrow shelf. Low bottom temperatures.

TABLE 1 (Sheet III)

1	2	3		4	5	6	7	8	9	10	11	12	13	14
4.2	ALASKA REGION													
4.2.1	Western Bering Gyral	- 5	12.5	Wi (centre of low) Su - S	> 6 2	Wi + Su -	1,000	At	0	8	33	Gyral	Weak	Irregular currents but average counter clockwise circulation. Very high nutrient content. Strong mixing between Aleutian Islands.	Deep oceanic area.
4.2.2	Alaska Coastal Waters	- 10	8.5	Wi - NE; Su - SE	> 6 ; 2	Wi +; Su -	600	(At)	< 1	8	32	Tidal (SE)	Weak	Northerly flow of warm, dilute, medium nutrient - content water. Mostly ice-covered in the winter.	Bering Shelf; 1.200,000 km^2. Average depth in NE 35 m. Low bottom temperatures. Irregular coast with many rivers.
4.2.3	Alaska Gyral	2.5	13	(Wi - S); Su - S	6 ; 2 - 3	Wi +++; Su +	2,000	At	4	13	32.5	Gyral	Weak	Subarctic water that turns E-ward and forms a counter clockwise gyral. Nutrient content high.	Deep oceanic area.
4.2.4	NW American Coastal Waters	5	13	(Wi - S); Su - NW	< 5; 1 - 2	Wi ++; Su -	> 2,000	All year (Wi)	13	15	< 32.5	(SW) Su - in S part NE	(Weak)	Northerly flow north of about 50°N and southerly in lower latitudes. Nutrients moderate to high.	Narrow shelf. Irregular coast.
4.3	NORTH CHINA AND JAPAN SEAS REGION														
4.3.1	North China Sea	7.5	> 25	Wi - N; Su - SE	4 ; 1	Wi -; Su +	1,500	(Sp)	10	27	33.5	Tidal (Wi - N Su - SW)	Weak > 0.5	Productive area. Great seasonal changes.	Area 1,000,000 km^2 Depth: W part 30 m. E part 80 m. Productive. E and S coasts rocky.
4.3.2	Sea of Japan	2.5	22.5	Wi - NW; Su - S	4 ; 1	Wi +; Su +	1,500	Sp	5	18	34	SW	Weak	Moderately productive. Great seasonal changes.	Relatively narrow shelf.
4.4	NORTH PACIFIC DRIFT REGION	3	16	Wi - W; Su - SW	> 6 ; 3 - 4	Wi +++; Su ++	> 1,500	Sp ; At	7	15	< 34	W	Wi - 1; Su < 1	Productive oceanic area with westerly flow of relatively warm water.	Deep oceanic area.
4.5	CENTRAL NORTH PACIFIC REGION														
4.5.1	North Pacific Gyral Waters	15	24	Wi - W; Su - (E)	Wi - 4; Su - 1	Wi ++; Su -	> 1,000	Wi (Sp)	16	25	35	(W)(Gyrals)	Weak	Slow circulation. "Old" unproductive waters.	Deep oceanic area.
4.5.2	S. Francisco Waters	15	18	Wi -(NE); Su - N	Weak ; 6	Wi + ; Su -	750	-	15	18	33.5	NE	0.5	Upwelling along the coast. Productive area.	Narrow continental shelf.
4.6	PACIFIC NORTH EQUATORIAL CURRENT REGION														
4.6.1	Philippine Waters	15	> 25	Wi - NE; Su - S/SE	> 3 ; 1 - 2	Wi ++; Su +	3,000	Su - At	20	> 28	34.5	SE	Wi - 1 - 2 Su - 0.5 - 1	Origin of Kuroshio. Poor thick surface water. Low productive.	Very little shelf.
4.6.2	Pacific N.Equatorial Current Waters	20	> 25	Wi - NE; Su - E	> 3 ; 1 - 2	-	2,000	(All year-At)	22	> 28	34.5	E	0.5	Unproductive, except on divergences along counter current region.	Deep oceanic area.
4.6.3	California Coastal Waters	18	25	Wi - N; Su - (N)	1 ; 2 - 3	-	< 250	-	16	23	34	NW	Weak	Moderate seasonal variations and moderate to high productivity, influenced favorably by upwelling further south.	Narrow shelf (including Gulf of California).
4.6.4	West Mexican Waters	26	27.5	Wi - NE; Su - (NW)	1 - 3; < 1	Su ++ (+)	1,500	Su - At	22	29	Wi > 34.5 Su < 33.5	SE	0.5	Small to moderate seasonal variations. Seasonal upwelling along the coast.	Very narrow continental shelf.
4.7	INDONESIAN REGION														
4.7.1	South China Sea	15	27.5	Wi - NE; Su - S	2 - 3	Wi - ; Su +	2,500	Su	20	> 28	33	Wi - N; Su - S	0.5 - 1	Shallow sea, Gulf of Siam and NW coast relatively productive.	South China shelf 2,300,000 km^2. Average depth 50 m. Low productive, except Gulf of Siam. Rocky and coralline.
4.7.2	Java and Flores Seas	> 25	> 25	Wi - NW; Su - SE	1 - 2; 2	-	200	Wi	27	27	33	Wi-NW; Su-SE	Weak		
4.7.3	Sulu and Celebes Seas	> 25	> 25	Wi - N; Su - SE	1 - 2	-	2,500	All year (At)	27	27	34	Wi-W; Su-SE	Weak ; 1	Low nutrient content in surface layers. Unproductive area.	
4.8	EQUATORIAL COUNTER CURRENT REGION	> 25	> 25	Wi - NE/E; Su - SE	1 - 2	-	2,000 - 3,000	All year (At)	24 (E part; 27)	28 28	< 34.5	W	Wi-weak; Su - 0.5	Low nutrient content in surface layers. Unproductive area except on divergences along counter current region. Oxygen minimum layer deep (500 - 1,000 m.). Current intensity and position varies seasonally.	
4.9	PACIFIC SOUTH EQUATORIAL CURRENT REGION														
4.9.1	North Polinesian Waters	> 25	> 27.5	Wi-NW/W; Su - SE	1 ; 2 - 3	-	2,000	All year (Wi - Sp)	27	28	34.5	E	< 0.5		
4.9.2	Coral Sea (NE Australian Waters)	22.5	> 25	Wi - E; Su - SE	2 - 3; > 3	+	1,200	Sp	19	27	35	Wi - E; Su-SE	Weak; 0.5	Relatively poor, except the southern part.	Queensland shelf 220,000 km^2. Depth < 40 m. Low productive, very rocky and coralline.
4.9.3	E.Tasman Sea Waters	15	20	Wi - E; Su - SE	3 ; 2 - 3	Wi +; Su ++	> 1,000	(Su)	16	22	> 35.5	(Wi - E) (Su - NE and SW)	0.5 ; weak	Moderately productive.	Tasmanian shelf on the western boundary.
4.9.4	Peru-Galapagos Waters	17.5	23	Wi-S; Su-SSE	2 - 3; 5 - 6	-	100	-	18	22	> 35	SE	Wi->0.5; Su > 1	Very productive waters.	Very narrow and rocky continen. shelf.

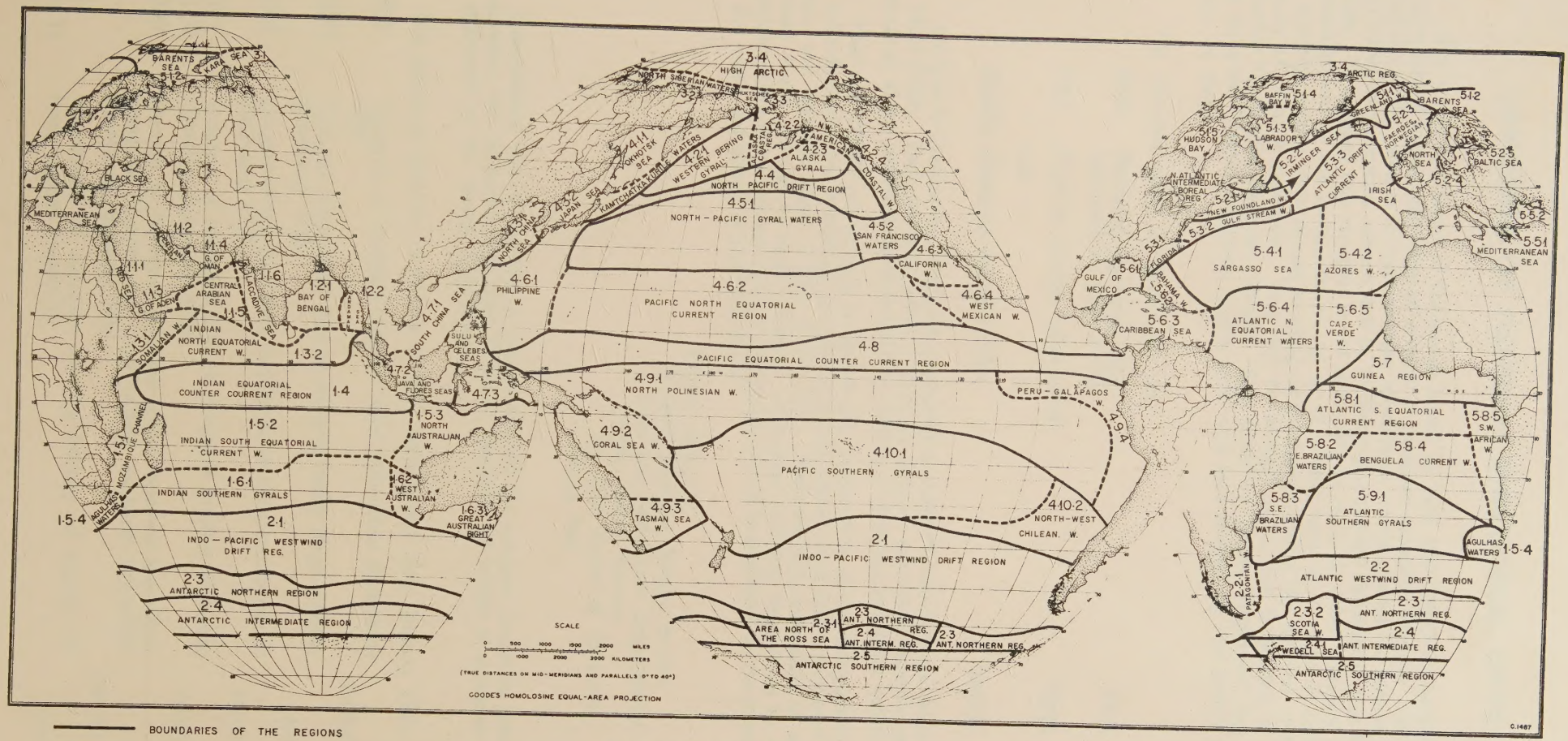
1	2	3	4	5	6	7	8	9	10	11	12	13	14
4.10	PACIFIC SOUTHERN GYRALS REGION												
4.10.1	Pacific Southern Gyrals	15	18	Wi - E; Su - SE	< 1 ; 2 - 3	Wi + ; Su -	1,500	Year around	17	23	> 35.5	Gyrals (EE)	Weak	Low productivity. "Old" surface waters.	Deep oceanic area.
4.10.2	SW Chilean Waters	7.5	17.5	Wi - SE; Su - W	3 ; > 6	Wi +; Su ++	> 1,500	Year around	10	17	< 34	SW	1	Moderately productive. Very stormy.	Irregular rocky coast.
5.1	ATLANTIC SUBARCTIC REGIONS														
5.1.1	E.Greenland Waters	- 25	5	EE	Wi - 6; Su -3	Wi ++; Su -	400	(At)	< - 1	0	32	NW	< 1	Cold E. Greenland current. Ice covered most of the year. Organic production high on southern boundary (mixing zone).	Very narrow shelf.
5.1.2	Barents Sea	- 15	5	Wi - SW; Su - N	6 ; 2	Wi ++; Su -	400		1	5	< 34	(SW)	Weak	Under the influence of warm North Cape Current. Mixing zone very productive. Covered with ice during winter.	850,000 km^2. Average depth: 200 - 300 m. Moderate productivity.
5.1.3	Labrador Waters	- 15	8	Wi - NW; Su - SW	4 ; 2	Wi ++; Su -	600		- 1	6	34.5	N	> 0.5	Cold arctic water. Mixing zone productive.	160,000 km^2. 120 m. depth. Very rocky. Numerous offshore islands.
5.1.4	Baffin Bay	- 27	4	Wi - N; Su - N	3 ; 2	Wi ++; Su -	250		< - 1	2	32	(N)	Weak	Cold area, covered with ice during greater part of year.	Narrow, rocky shelf.
5.1.5	Hudson Bay	- 25	10				400		< - 1	3	28	-	-	Ice covered during greater part of the year.	1.010,000 km^2. Depth 60 - 150 m. Low productivity.
5.2	N.ATLANTIC INTERMEDIATE BOREAL REGION														
5.2.1	New Foundland Waters.	- 5	13	Wi - W; Su - SW	4 ; 2	Wi +++; Su +	> 1,000	Wi	0	13	32	NW	> 1	Very productive area under the influence of cold Labrador current. Mixing area.	N.Foundland and Nova Scotia shelves. 770,000 km^2. Depth 60 - 150 m. Bottom groupy
5.2.2	Irminger Gyral	- 3	8	SW	Wi - 5 Su - 2	Wi + Su -	> 1,000	Wi	3	9	35	(EE)	Weak	Warm Irminger current. Productive in boundary regions (mixing).	
5.2.3	Norwegian Sea - Faeroes Waters	- 2	10	SSW	Wi > 6 Su - 2	Wi ++ Su -	< 1,000	At - Wi	5	12	35	SW	Weak	North Atlantic Drift - Norwegian Current. Productive.	Norwegian Shelf, 93,000 km^2. Depth 200 - 300 m. Iceland - Faeroes Shelf: 115,000 km^2 Depth: 200-300 m. Many bays and fjords.
5.2.4	N.Sea, Irish Sea, English Channel	2	15	SW	Wi - 3 Su - 2	Wi ++ Su -	700	At - Wi	7	16	34	Tidal (SW)(NW)	-	Shallow area, medium productivity.	North Sea: 575,000 km^2;depth 94 m. English Channel: 75,000 km^2 Depth 54 m.
5.2.5	Baltic Sea	- 4	17	SW	2 - 3	Wi +; Su -	400	At	0	17	2 - 28	-	-	Brackish water. Medium to low productivity.	Baltic Sea: 390,000 km^2. Depth 100 m.
5.3	GULF STREAM - ATLANTIC DRIFT CURRENT REGION														
5.3.1	Florida Waters	15	27	Wi - W; Su - SE	1 ; < 1	Wi + ; Su -	> 1,000	Year around	23	28	36	S	2	Very strong currents. Low productive.	
5.3.2	Gulf Stream Waters	5	20	Wi - W; Su - S	2 ; < 1	Wi ++; Su -	> 1,000	Year around	15	25	35.5	SSW	1.5	Strong currents. Low productive.	New England - Carolina shelf 220,000 km^2. Depth 35 - 80 m.
5.3.3	Atlantic Drift Current Waters	5	15	SW	Wi 2-3 Su 1-2	Wi +++; Su +	< 1,500	Wi	10	15	35.5	SW	1	Medium to low productive, except in N. boundary.	Deep oceanic area, except Gulf of Biscay. 80,000 km^2 Depth 130 m.
5.4	CENTRAL NORTH ATLANTIC REGION														
5.4.1	Sargasso Sea	18	27	Wi - ; Su - E	(1) ; -	Wi + ; Su -	700	Wi - Sp	20	27	> 36.5	Gyral	-	Unproductive.	Deep oceanic area.
5.4.2	Azoren Waters	13	20	NNE	1(F); > 2(A)	Wi + ; Su -	500	Wi - Sp	17	22	36.5	NNE	< 0.5	Unproductive area (Bay of Cadiz is slightly more productive). Small continental shelf.	West Pyreneian 50,000 km^2 Depth 250 m. Rocky.
5.5.1	Mediterranean														
	Western Basin	12	25	Wi - NW; Su - N	Weak > 1; < 1	Wi ; Su -	600	Wi	13	24	< 37.5	S part - W N part - E	-	Strait of Gibraltar and western part productive. Rest unproductive.	Balearian and Gulf of Lion 40,000 km^2 Depth 150 - 100 m.
	Eastern Basin	14	28	Wi - W ; Su - NW	> 1 ; > 2	Wi + ; Su	300	Wi	15	28	> 38.5	No tides	-	Adriatic sea is shallow, cooler and less saline. Aegean Sea also cooler.	Adriatic shelf 80,000 km^2. Depth 30 - 150 m.

TABLE I (Sheet V)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
5.5.1	Mediterranean Eastern Basin (Cont.)												Sicilian - Sidra shelf: 130,000 km² Depth: 50 - 100 m.
5.5.2	Black Sea	0	23			> 500		5 23	14 - 28	No tides.	-	Brackish surface, H_2S in deep water. Azov sea was very productive.	
5.6	ATLANTIC NORTH EQUATORIAL CURRENT REGION												
5.6.1	Gulf of Mexico	22	28	Wi - NE ; Su - W	Wi - 2 ; 1	-	> 500	At - Wi	22 29	> 36	N part - Gyral SE part - SW	> 1.5	Large closed water body with predominantly low coast and large shelf. Low productive. Small seasonal variations.	Florida - Texas shelf: 450,000 km² Depth: 40 m. Shallow coast. Florida shelf coralline. Campeche 180,000 km². Depth 30 m. Rocky and coralline.
5.6.2	Bahama Waters	22	28	E	Wi - 1 - 2 Su - 2	-	> 500	(At - Wi)	24 29	36.5	NW	1	Shallow area with great banks. Small seasonal variations. Very low production.	Bahama shelf, 130,000 km². Depth 15 m. Reefy.
5.6.3	Caribbean Waters	25	27.5	E ; (Trades)	2 - 4	-	500 SW part>1,000	At	26 28	< 36	E	> 1	Large closed water body with coralline coast. Low productive, except SE part, where minor upwelling occurs.	Mosquito: 110,000 km². Depth 25 m. Rocky; coralline; many offshore bars Venezuela: 130,000 km². Depth 20-80 m. Rocky; coralline, groupy.
5.6.4	Atlantic N.Equatorial Current Waters	25	>25	NE	Wi > 5; Su > 3	-	800	Wi - Sp	26 27	35.5	E	0.5 - 1.5	Unproductive oceanic area with "old" surface waters.	Amazon: 540,000 km². Depth: 15 - 70 m. Rocky, coralline.
5.6.5	Cape Verde Waters	20	24	NNE	Wi 3 ; Su 3	-	100		21 24	36.5	NE	0.5	Slight upwelling in several locations along the coast. Productive along the coast and on SE boundary.	
5.7	GUINEA REGION	> 25	< 25	Wi - S and N Su - SSE	2	-	2,000	Su - At	24 27	34.5	NW W	1 - 2	The NE boundary on the Sierra Leone shelf is productive. The rest of the area low productive with very narrow shelf. O_2 minimum layer in ca. 100 m depth.	Sierra Leone, Guinean shelf: 210,000 km² Depth: 25 m.
5.8	ATLANTIC S.EQUATORIAL CURRENT REGION													
5.8.1	Atlantic S.Equatorial Current Waters	24	26	SE	> 3	-	150	(Sp)	24 27	36.0	E	1	Low productive oceanic area. O_2 min. layer close to surface (ca. 50 m.).	
5.8.2	E.Brazilian Waters	23	> 25	SE	Wi - 3; Su > 4	-	> 500	(Su)	24 27	> 37	NE	0.5	Low productive except around Cabo Frio.	E.Brazilian shelf 400,000 km². Depth 80 m. Numerous lagoons and offshore bars. N. part: rocky.
5.8.3	SE.Brazilian Waters	15	18	NE	1 - 2	-	700	(Su)	19 24	36.5	N	0.5		
5.8.4	Benguela Current Waters	18	22	SE	Wi > 3; Su > 4	-	< 100		17 22	36.0	SE	0.5 - 1	Oceanic area with medium production.	
5.8.5	SW.African Waters	17	22	SSE	> 3	-	100		16 21	35.5	S(SSE)	< 0.5	High productive area. Extensive upwelling along the coast. O_2 minimum layer close to surface.	St.Helena shelf 140,000 km². Depth 150 m. Productive.
5.9	ATLANTIC SOUTHERN GYRALS REGION	15	20	(Often quiet)	1 - 2	-	500	Year around	15 20	35.5	-	-	Low productive oceanic area.	

Table II - Groups of Natural Regions of the Ocean with Similar Environmental Conditions

		Groups of similar regions (names see Table I and locations see Figure 1).	
Polar	High Polar Regions	Group I	2.5; 3.4
		Group II	3.1; 3.2; 3.3
	Subpolar Regions	Group III	2.4; 4.1; 5.1
		Group IV	4.2; 5.2; 2.3
Boreal	Westwind Drift Regions	Group V	2.1; 2.2; 4.4; 5.3.2
	Subtropical Gyrals	Group VI	4.5.1; 5.4.1; 4.10.1; 5.9.1; 1.6.1
	Eastern upwelling Regions	Group VII	4.5.2; 5.4.2; 5.8.5; 4.9.4
		Group VIII	4.6.3; 4.6.4; 5.6.5; (1.5.3?)
		Group IX	4.10.2; (1.6.2)
Tropical	Equatorial Current Regions	Group X	4.6.2; 4.9.1; 5.8.1; 1.5.2
	Western Subtropical Gradient Current Regions	Group XI	5.6.1; 5.6.2; 5.6.3; 5.8.2; 5.8.3; 1.5.1; 1.5.6; 1.3.1; 4.9.2; 4.9.3; 4.6.1
	Equatorial Counter Current Regions	Group XII	1.4; 4.8; 5.7
	Indo-Pacific Monsoon Regions	Group XIII	1.1; 1.2; 1.3; 4.7
		Group XIV	4.3; (5.3.1)



BOUNDARIES OF THE REGIONS

BOUNDARIES OF THE SURFACE WATERS

NATURAL REGIONS OF THE OCEANS

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SYNOPSES OF FISHERIES BIOLOGICAL DATA

This is one of a series of documents issued by FAO and CSIRO concerning species and stocks of aquatic organisms of present or potential economic interest. The primary purpose of the series is to make existing information readily available to fishery scientists according to a standard pattern, and by so doing also to draw attention to gaps in knowledge. It is hoped that synopses in the series will be useful to other scientists initiating investigations of the species concerned or of related ones, as a means of exchange of knowledge among those already working on the species, and as the basis for comparative study of fisheries resources. They will be brought up to date from time to time, as further information becomes available. It is, therefore, recommended that they be filed in loose-leaf folders; pagination begins anew with each chapter, so that partial revisions may be made.

The relevant series of documents are:

FAO	**Fisheries Synopsis No.** (replacing, as from 1.1.63	FIb/S
FAO	Fisheries Biology Synopsis No.	FB/S)
	and	
CSIRO	**Fisheries Synopsis No.**	DFO/S

Synopses in these series present data compiled according to a standard outline described in FB/SI (1962). Steps are being taken to form an advisory association comprising representatives of the participating organizations, authors of synopses and other collaborators.

FAO and CSIRO are working to secure the co-operation of other organizations and of individual scientists in drafting synopses on species about which they have special knowledge, and welcome offers of help in this task. Additions and corrections to synopses already issued will also be most welcome. Comments including suggestions for the expansion of the outline and requests for information should be addressed to the co-ordinator of this work and editor of the FAO series.

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Consolidated lists of species or groups covered by synopses issued to date or in preparation will be issued from time to time. Requests for copies of synopses should be addressed to the issuing organization.

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DFO/S1	Synopsis of biological data on the grey mullet *Mugil cephalus* (Linnaeus) 1758	June 1963
FIb/S28	Synopsis of biological data on pike-perch *Lucioperca lucioperca* (Linnaeus) 1758	March 1964
FIb/S24 (Rev. 1)	Synopsis of biological data on European grayling *Thymallus thymallus* (Linnaeus) 1758	March 1964
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